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ABSTRACT

This report presents the research findings from the second year of a continuing investigation to determine the diffusion patterns to university professors of four specific educational innovations developed by the IMPACT Program. Issues addressed include: (1) creation of a corps of secondary and tertiary receivers, (2) future adoption and discontinuance, (3) nature of local information dissemination networks, (4) relative effectiveness of various diffusion strategies, and (5) the implementation process for educational innovations. The diffusion strategies of the NEXUS, CONDUIT, and Strategies for Change and Knowledge Utilization Project are compared to those of the IMPACT Program. Implications of the IMPACT Program's diffusion patterns for other programs of innovation in higher education are discussed. (STS)

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DIFFUSION OF IMPACT INNOVATIONS FROM 1973-76: INTERPERSONAL COMMUNICATION NETWORKS AMONG UNIVERSITY PROFESSORS

A Report to the Exxon Education Foundation

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SUMMARY

The main purpose of the present research is to determine how educational innovations diffuse to university professors as part of the IMPACT program of the Exxon Education Foundation, which was launched in 1973. This report presents our research findings from the second year of an on-going investigation of the diffusion of innovations in higher education.

During the first year of this research, in 1974-75, we gathered data via mailed questionnaires from 3,058 individuals who had requested information about four IMPACT innovations (EXPER SIM, Guided Design, TIPS, and Student-to-Student Counseling) from the inventors of these new ideas, and via personal and telephone interviews with 55 IMPACT grantees, 64 spontaneous adopters, and with a small sample of 52 secondary receivers (who had discussed at least one of the four IMPACT innovations with an information requestor).

In the past year of this research (1975-76), we gathered information from eight additional data-sets, representing (1) 109 secondary receivers, (2) 73 tertiary receivers, (3) individuals in three local networks, at West Virginia University, the University of Wisconsin

Center System, and at Stockton State College, (4) 38 IMPACT grantees in 1975, and 35 grantees in 1974, and (5) samples of 120 intend-to-adopters (originally obtained from our 1974 mailed survey), and 96 possible adopters that were nominated by the four inventors in 1975-76.

These data, and other information, were analyzed to answer six main research questions in the second year of our investigation.

I. How do the IMPACT grantees, spontaneous adopters, and requestors diffuse the four innovations among their peers so as to create a corps of secondary receivers and tertiary receivers, and with what effects?

An estimated 7,073 information requests were made for the four IMPACT innovations during the first 26 months of the IMPACT program (through December, 1975). We conclude that the number of requests for the four IMPACT innovations follows an S-shaped curve when plotted cumulatively over time, without much evidence of leveling-out, although the average number of requests per month dropped somewhat (from 273 in 1973-1974, to 213 in 1974-1975).

Mass media sources/channels are relatively more important in creating awareness-knowledge in the early stages of the diffusion process (such as for information requestors), but interpersonal channels play a somewhat more important role at later stages in the diffusion process (such as for secondary and tertiary receivers).

The rate of interpersonal diffusion about the four IMPACT innovations (as indicated by the average number of non-overlapping individuals contacted) is greater for the secondary receivers than for the information requestors, and lowest for the tertiary receivers.

The adopters of an innovation are more actively involved in the interpersonal diffusion of the four IMPACT innovations than non-adopters, with the intend-to-adopters at an intermediate level of interpersonal diffusion activity.

A majority of interpersonal communication about the four IMPACT innovations is between colleagues in the same department or on the same campus. The rate of interpersonal diffusion generally decreases from secondary receivers, to tertiary receivers, to fourth-level diffusion.

A ratio of proposals to information requestors (as a percentage of information requestors who made a proposal) suggests that individuals aware of computer-dependent educational innovations are less likely to make a proposal for an implementation grant.

The overall ratio of adopters to proposal-makers is higher for EXPER SIM and Guided Design than for TIPS and Student-to-Student Counseling. The percentages of proposal-makers to grantees are lower for Student-to-Student Counseling than for the other three innovations. Of the unsuccessful proposal writers, about four percent became spontaneous adopters of one of the four IMPACT innovations.

TIPS proposal-makers were especially unlikely to be in this category.

2. What future adoption, and perhaps discontinuance, will occur among the individuals who are presently requestors, grantees, and spontaneous adopters?

The overall rate of (estimated) adoption of the four innovations is about 10 percent for the information requestors, secondary receivers, and tertiary receivers. The rate of adoption is highest for secondary receivers (14 percent), lower for tertiary receivers (10 percent), and lowest for information requestors (7 percent).

Of the 487 confirmed adopters of the four innovations, 461 (95 percent) are satisfied users who have not discontinued. Grantees for the four IMPACT innovations and the spontaneous adopters are quite similar in their rates of discontinuance, with grantees showing a slightly higher proportion of discontinuance than do spontaneous adopters.

We expect that a majority of future adoptions will be among the 578 individuals who have gone beyond the state of being an information requestor, to a more advanceddstage of interest in an innovation (as indicated by submitting a grant proposal); second most likely to be future adopters are the "intend-to-adopt" individuals. Of the 471 estimated intend-to-adopt individuals, 174 new adopters of the four

IMPACT innovations are expected. Least likely to be future adopters, by our estimates, are the information requestors (N=9,186) who have awareness-knowledge about the IMPACT innovations, but have not yet adopted.

3. What is the process of implementation for the four IMPACT innovations?

The innovation process consists of the two sub-processes of initiation and implementation. Implementation is the sub-process in the innovation process that begins with the decision to adopt an innovation, and continues through the steps involved in using the innovation, until the innovation is institutionalized to the point at which the idea loses it newness and has become an unrecognizable element in the adopting unit's ongoing operations.

The consequences of the four IMPACT innovations (1) are generally perceived by adopters and students as favorable, and (2) are usually evaluated as advantageous when compared to traditional approaches to teaching/counseling in field experiments.

Re-invention is the degree to which an innovation is changed in the process of implementation (Agarwala-Rogers, 1977). Why does re-invention occur? Some adopters may have a "prima donna" complex in insisting that the innovation is their own invention, an attitude perhaps motivated by local pride, such as in giving an innovation a name that implies a local identity. The IMPACT innovations sometimes go through a re-invention process as the innovation is applied to meet an institution's problems and characteristics, such as class size, nature of the student body, make and model of the computer used, disciplinary subject matter, and so on. Thus an innovation is not always implemented as envisioned by the inventor.

4. What is the comparative nature of the diffusion of further IMPACT innovations that are selected?

A fifth and sixth IMPACT innovation were announced about midway through the 1975-1976 year: (1) CVIS (for "Computerized Vocational Information System"), a package computer software that provides a series of career-guidance experiences for direct use by the student along with certain administrative-counselor support functions and (2) the Dartmouth Intensive Language Model, which is centered on the use of qualified undergraduate "assistant teachers" who help the master teacher.

Unfortunately we were unable to gather data about the diffusion and adoption of these two IMPACT innovations during 1976. So comparison of these two innovations with the original four IMPACT innovations remains only a promising research lead.

5. What is the nature of local networks that seem to affect the diffusion of the four IMPACT innovations?

A network consists of interconnected individuals who are linked by patterned communication flows.

Interpersonal networks for Guided Design at West Virginia University were concentrated on each of its three sub-campuses. There were 52 primary requestors, who nominated 48 non-overlapping secondary receivers, who in turn nominated 15 non-overlapping tertiary receivers of Guided Design.

Interpersonal diffusion networks at West Virginia University are determined in part by space and discipline. There is much less interpersonal diffusion between the three sub-campuses, than there is within each sub-campus.

Adopters of Guided Design are more actively involved in interpersonal diffusion than are non-adopters, supporting our earlier, more general, findings.

The University of Wisconsin Center System - Washington County was our second network study where we did a small " roster " study among the 16 persons on 14 campuses of this community college system. A majority of the respondents were directors of student counseling centers who first heard about Student-to-Student Counseling from Professor Roland Baldwin. None of the respondents had adopted the innovation.

There is very little interpersonal communication between the IMPACT grantee for Student-to-Student Counseling and his counterparts on the other campuses in his state system of community colleges.

The third network study was at the Stockton State College in New Jersey, where 26 persons received our questionnaire. They had access to the New Jersey Educational Computing Network.

A majority of the respondents heard about TIPS from the newsletter sent to them in the early part of 1975 by the NJECN and Professor Ken Tompkins, announcing the workshop on TIPS at the Stockton State College.

Most of the respondents were not actively involved in the secondary diffusion of TIPS. A majority of the respondents had used computers for research but not for teaching prior to their exposure to TIPS.

6. What is the relative effectiveness of various strategies for diffusing educational innovations?

There are two main approaches to innovation in higher education: (1) an innovation specific strategy, and (2) a general change strategy.

An innovation specific strategy is a plan designed to diffuse a particular new idea, object, or practice among the members of an audience. Measurement of the effectiveness of the program is facilitated by the specific focus on a single innovation. A general change strategy is a plan designed to create a climate for innovation by promoting change and development among an audience, that may encourage the adoption of a variety of different innovations.

IMPLICATIONS OF THE IMPACT PROGRAM FOR OTHER PROGRAMS OF INNOVATION IN HIGHER EDUCATION

1. Educational innovations-decisions seldom involve just individuals alone. A college teacher or administrator does not act in isolation. The social structure of the organization directly affects the individual's innovation behavior. Most of the decisions to adopt an innovation in education are collective and/or authoritative, with implications for the entire system. For example, most of our present respondents reported that the support of their administrator(s) was crucial in their adoption of one of the four IMPACT innovations. Our interviews showed that two or more individuals were often involved in the adoption decision of the four innovations that we investigated.

2. Mass media channels/sources are much more important than interpersonal channels in creating awareness-knowledge of educational innovations, but interpersonal channels such as direct contact with the inventor, change agent, or the sponsors of the innovations, are more important in motivating adoption of an innovation.

3. Interpersonal contact with the inventor or with another adopter during the implementation phase of the innovation-decision process is especially important. Such contact helps decrease the uncertainty and risk involved in the adoption of a new idea.

4. A site visit by the potential adopter to institutions where the innovation is currently in use enhances the credibility of the innovation. It gives the innovation a "good housekeeping seal of approval," and provides a visibility which is unsurpassable (and difficult, to achieve) through just words alone.

5. Innovations which do not require a radical shift in teaching/counseling style, or a redistribution of resources and loci of control, are more likely to be adopted.

6. The cost of innovating is an important determining factor in the eyes of adopters, and the administrators who give sanction for adoption. Innovations involving a major commitment of resources (initially and later), even though the initial cost may be provided by an external source, are less likely to be adopted. Cost considerations are influenced by the urgency and seriousness of the felt need for an innovation.

7. Innovations involving computers are sometimes slowed by problems of computer compatability and the transferability of computer programs.

8. Innovations are not "invariant" as assumed in past research on the diffusion of innovations; a great deal of "re-invention" takes place in the process of adoption.

An innovation often is not a fixed entity as it diffuses within a system; a new idea is frequently recreated in the process of implementation by an adopter. Reasons for re-invention are a lack of information about the innovation on the part of adopters, a desire for recognition and local pride by adopters, and the differing local conditions and problems of adopters from those of the inventor.

9. The two main innovation strategies in higher education are: (1) innovation specific, and (2) a general change strategy. An innovation-specific strategy is a plan designed to diffuse a particular new idea, while a general change strategy is a plan designed to create a climate for innovation by promoting change and development among an audience that may encourage adoption of a variety of different innovations. The Exxon Education Foundation used an innovation-specific strategy in the IMPACT Program evaluated by the present authors. Faculty development centers are an example of the general change strategy.

10. Primary information-requestors interpersonally diffuse an innovation to secondary receivers who, in turn, pass the information on to tertiary adopters, and so on. We found that a modest number of individuals (about 4,000) requested information about the four IMPACT innovations in 1973-75; they discussed these four innovations with a total of about 10,000 individuals by mid-1976.

Thus, one of the main approaches to innovation in higher education is to launch an innovation with a critical mass of individuals who then spread it interpersonally among their peers.

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1. Dr. Richard Johnson and the other staff of the Exxon Education Foundation, who sponsored the present research and who provided us with access to certain of the data-sets that we utilized in this research .

2. The inventors of the four IMPACT innovations that are our main objects of study: Professor Dana Main at the West Virginia College of Graduate Studies, Professor Charles Wales at West Virginia University, Professor Allen C. Kelley at Duke University, and Professor William F. Brown at Southwest Texas State University.

3. The key figures in our three local networks of study: Professor Charles Wales at West Virginia University, Professor Roland Baldwin at the University of Wisconsin Center System, and Professor Kenneth Tompkins at Stockton State College.

4. Our colleagues and co-workers at Applied Communication Research.

5. The 15 diffusion scholars and executives of funding agencies in higher education who met in May, 1976 in New York to review the IMPACT program and the present investigation. Our present report profits directly from these discussions.

6. Our respondents, who willingly shared with us their experiences with the IMPACT innovations.

TABLE OF CONTENTS

Page

BACKGROUND 1

THE PRESENT RESEARCH IN 1975-76 8

DATA-GATHERING ACTIVITIES DURING 1975-75 13

Data-Set # 7: Secondary Receivers 13

Data-Set # 8: Tertiary Receivers 21

Data-Set # 9: West Virginia University Network 22

Data-Set #10: University of Wisconsin Center System Network 23

Data-Set #11: Stockton State College Network 24

Data-Set #12: 1975 Grantees 25

Data-Set #13: Follow-Up with 1974 Grantees 26

Data-Set #14: Continued Monitoring of Spontaneous Adopters Originally Identified in the 1974 Survey 26

Data-Set #15: Continued Monitoring of Spontaneous Adopters Mentioned by Inventors 27

SECONDARY AND TERTIARY DIFFUSION 28

Rate of Information Requests through 1975 29

Diffusion of the Four IMPACT Innovations to Information Requestors, Secondary Receivers, and Tertiary Receivers 33

TABLE OF CONTENTS

Page

Rate of Interpersonal Diffusion of the Four IMPACT Innovations 39

Rate of Adoption of the Four IMPACT Innovations by Level of Interpersonal Diffusion 45

Differences and Similarities of Dyadic Individuals by Level of Interpersonal Diffusion 51

Differences and Similarities of 1974 Grantees versus 1975 Grantees 60

Ratios of Information Requestors, Proposals, and Adopters 64

FUTURE ADOPTION AND DISCONTINUANCE 69

Sources of Data on Discontinuance 70

Interviews with Adopters Who Discontinued 74

Reasons for Adoption 75

Further Adoption of the Four IMPACT Innovations . . . 78

IMPLEMENTATION 82

FURTHER IMPACT INNOVATIONS 102

LOCAL DIFFUSION NETWORKS 104

Interpersonal Networks at West Virginia University . . . 104

Data Collection at West Virginia University 108

Characteristics of the West Virginia University Network 110

TABLE OF CONTENTS

Page

Diffusion Networks at the Three WVU Sub-Campuses 115

University of Wisconsin Center System Network 120

Stockton State College Network 125

DIFFUSION STRATEGIES IN HIGHER EDUCATION 128

NEXUS 130

CONDUIT 133

Strategy for Change and Knowledge Utilization Project 134

Comparison of the Two Strategies 137

REFERENCES CITED R-1

APPENDIX A A-1

BACKGROUND

During 1974-75, the Exxon Education Foundation sponsored a research project by the Interdisciplinary Program in Mass Communication Research (headquartered in the Department of Journalism) at the University of Michigan, DIFFUSION OF IMPACT INNOVATIONS TO UNIVERSITY PROFESSORS. This study's main purpose was to determine how four IMPACT innovations diffused to university professors. The four IMPACT innovations, selected by the Exxon Education Foundation in 1973 when the IMPACT program was launched, are:

1. EXPER SIM - a system for teaching research design through computer simulation, developed by Professor Dana Main now at the West Virginia College of Graduate Studies.

2. Guided Design - a combination of self-study of subject matter and guided decision-making in solving open-ended real-world problems, developed by Professor Charles Wales at West Virginia University.

3. TIPS - a computer-assisted method of monitoring each individual student's progress in a course, identifying specific weaknesses and strengths in his grasp of the subject matter, and of prescribing corrective study, developed by Professor Allen C. Kelley at Duke University.

4. Student-to-Student Counseling - based on systematic training methods and materials developed to maximize the effectiveness of student counselors in counseling students about academic and personal-social matters, developed by Professor William F. Brown at Southwest Texas State University.

Our 1974-75 study was organized around eight main research questions:

1. What communication channels are most important at the awareness-knowledge, persuasion, and decision stage in the innovation-decision process for university professors?

2. How do IMPACT grantees, spontaneous adopters,* and requestors** act as local demonstrators of the four innovations, creating a secondary diffusion to their peers?

3. What are the most important resistances and barriers to the diffusion and adoption of the four innovations?

4. To what extent are the four innovations modified (such as being simplified or changed completely) in the process of their diffusion and implementation?

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* Spontaneous adopters are individuals who adopted an IMPACT innovation (1) prior to the IMPACT program, or (2) since the IMPACT program but without a grant from the Exxon Education Foundation.

**Requestors are individuals who contacted the inventors and/or sub-inventors to ask for detailed information about one of the IMPACT innovations.

5. *What are the characteristics and motivations of the IMPACT inventors, applicants, grantees, spontaneous adopters, requestors, and secondary receivers?*[*]

6. *What are the consequences and effects of the four innovations after their adoption by grantees and by spontaneous adopters?*

7. *How are the four innovations perceived by faculty members, students, and administrators, and how do these perceived attributes of the innovations (such as their relative advantage over existing practice, complexity, etc.) affect their rate of diffusion and adoption?*

8. *What diffusion strategies (for example, financial incentives for adoption or a special message aimed at a particular audience) might be tested in field experiments to alter the rate of diffusion of the four innovations?*

Certain of these eight research questions could be answered more adequately than others by our research. Data were gathered (1) through mailed questionnaires to the 3,058 individuals who had requested information about the four IMPACT innovations from the four "inventors" and one "sub-inventor", (2) via personal and telephone interviews with all of the 55 IMPACT grantees, 29 of the 30 pre-IMPACT spontaneous adopters, and 35 of the 209 post-IMPACT spontaneous adopters, and (3) through telephone interviews with a small sample of 52 of the approximately 3,489 "secondary receivers", who had discussed at least one of the four IMPACT innovations with an information requestor.

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[*] *Secondary receivers* are individuals who learn about an IMPACT innovation through interpersonal communication with adopters and/or information requestors.

The research results were presented in a final report entitled DIFFUSION OF IMPACT INNOVATIONS TO UNIVERSITY PROFESSORS (Rogers and others, 1975) that was submitted to the Exxon Education Foundation in November, 1975. Our main findings were as follows:

1. The most frequently mentioned source/channel of information about the four IMPACT innovations was the IMPACT brochure from the Exxon Education Foundation, mentioned by 54 percent of the responding requests.

2. The responding requestors talked with an average of 0.92 secondary receivers about an IMPACT innovation. About 49 percent of all requestors talked to at least one secondary receiver. Secondary diffusion mostly consisted of information exchange about the IMPACT innovations, rather than influence flow or persuasion.

3. The secondary receivers talked to an average of 1.55 tertiary receivers about the IMPACT innovations.

4. The most important reasons for non-adoption by the requestors, they reported, are the unavailability of (1) funds to adopt the innovation, (2) time, and (3) specially-trained personnel, such as computer programmers.

5. The computer-dependence of EXPER SIM and TIPS may be a retarding influence on their rate of adoption, but our evidence on this point is not very strong.

6. Most of the adoption decisions for the four IMPACT innovations may be collective (rather than individual-optional) in nature, involving colleagues, administrators, and inventors/sub-inventors. Administrators' support for the IMPACT innovations is a rather strong influence on adopters' innovation-decisions.

7. Despite considerable modification by adopters in the format, presentation, computer programs, and illustrative materials for the four IMPACT innovations, those ideas are mainly adopted with little or no expansion and/or re-invention.

8. Certain of the modifications in the four IMPACT innovations are caused by their adoption by individuals in different disciplines than those of the inventors.

9. The nature of the innovation, as well as the policy of the inventor, are factors determining the degree to which modification, expansion, and/or re-invention of the innovation occurs.

10. Adopters are less likely to request information for more than one of the four IMPACT innovations than are other requestors.

11. Requestors tend to be in the same discipline as the inventors for each of the IMPACT innovations, but many requestors are not.

12. Teaching faculty who request information about the IMPACT innovations are about as likely to adopt as are administrators.

13. Adopters tend to be at universities with larger student enrollments than are other requestors. Spontaneous adopters tend to be employed at universities with larger student enrollments than are grantee-adopters.

14. Adopters and non-adopters do not differ much on perceptions of the importance of teaching in their institutions' reward systems.

15. Gourman scores on "academic quality" of the institution are higher for adopters than for non-adopters of the three IMPACT teaching innovations, but the reverse is true for Student-to-Student Counseling.

16. Applicants awarded IMPACT grants are distinctive from non-grantee applicants in certain respects; for example, they are more likely to be teaching faculty or counselors at larger-sized institutions.

17. The consequences of the four IMPACT innovations are generally perceived by adopters and their students as favorable, and are evaluated as advantageous when compared to traditional approaches to teaching/counseling, in field experiments conducted by certain adopters.

18. The relative advantage of the four IMPACT innovations is perceived as a very important characteristic of the innovations by their adopters.

19. The college professor's need to perform as a lecturer is negatively related to the rate of adoption of the three teaching innovations.

20. An innovation's degree of compatibility with existing values, felt needs, and past experience does not seem to be strongly related to the individual's rate of adoption.

21. Complexity is not perceived by the adopters as an important barrier to the rate of adoption of the four IMPACT innovations.

22. Partial adoption of the IMPACT innovations is very common, suggesting that their trialability may be related to their rate of adoption.

23. Observability is perceived by the adopters as positively related to their rate of adoption of the four IMPACT innovations.

24. Almost no one discontinued using one of the IMPACT innovations in 1973-75, and most adopters perceive their innovations quite favorably. However, only a few months or years of experience with one of the innovations was gained at that point by the adopters.

THE PRESENT RESEARCH IN 1975-76

The following research questions were pursued with the data already at hand, and especially with that gathered during 1975-76.

1. How do the IMPACT grantees, spontaneous adopters, and requestors diffuse the four innovations among their peers so as to create a corps of secondary receivers and tertiary receivers,* and with what effect?

How many of the approximately 2,748 secondary receivers (that are estimated at present) will adopt one or more of the four IMPACT innovations during 1975-76? To what extent do these peer-to-peer dyads involving secondary receivers break outside of disciplinary-based boundaries? Of university boundaries? To what extent do the secondary receivers further diffuse the four IMPACT innovations to tertiary receivers?

Our small pilot study of 52 secondary receivers in Phase III of the 1974-75 study suggested that much could be learned about the in-process aspects of diffusion (1) by gathering data from a larger sample of secondary receivers and from tertiary receivers, so as to obtain a more adequate knowledge base, and (2) over a longer time period, when more secondary (and tertiary) diffusion would have occurred. Such secondary and tertiary diffusion through interpersonal communication is a main focus of our 1975-76 investigation.

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* Tertiary receivers are individuals who learn about an IMPACT innovation through interpersonal communication with secondary receivers.

2. What future adoption, and perhaps discontinuance, will occur among the individuals who are presently requestors, grantees, and spontaneous adopters?

This issue calls for monitoring and further investigation of the in-process diffusion of the four IMPACT innovations among the respondents from whom data were originally gathered in 1974-75. How are the innovations further modified as they diffuse to others? How much discontinuance, and modification, occurs when the original grant period is completed?

3. What is the process of implementation for the IMPACT innovations?

Here we seek to determine the consequences of the four innovations for particular professors/counselors, in specific courses and at various institutions, and for particular types of students. Numerous evaluations by adopters are underway of the effects of the four IMPACT innovations, and we obtained and synthesized many of these evaluation results. We sought to determine the variables that account for differences in the relative effectiveness of the IMPACT innovations as they are implemented by various adopters.

4. What is the comparative nature of the diffusion of further IMPACT innovations that are selected?

Two additional innovations were included in the IMPACT program in 1975-76: (1) CVIS, a computerized aid to placement and career counseling, and (2) the Dartmouth intensive language model. How do their perceived characteristics affect their diffusion? This research issue could approach a field experimental design to the extent that the additional innovations differ from EXPER SIM, Guided Design, TIPS, and Student-to-Student Counseling in such matters as their computer-dependence, the degree of perceived need by potential adopters that they promise to meet, etc. Data on the two newer IMPACT innovations could facilitate comparison of the tentative conclusions about diffusion of the four IMPACT innovations that were already drawn.

5. What is the nature of local networks* that seem to affect the diffusion of the IMPACT innovations?

Our first year's research suggested the importance (1) of regional networks (such as the chemistry professors in the Wisconsin state university system who adopted ChemTIPS), (2) of within-university networks (such as at West Virginia University for Guided Design), and (3) of within-department networks of colleagues (such as at the University of Louisville Department of Psychology, where several faculty members have adopted EXPER SIM). Three such locally-based networks were selected for intensive study in 1975-76. Essentially, this research approach is a "micro-level" study of diffusion, which hopefully supplements and extends our prior "macro-level" understandings about diffusion of the IMPACT innovations. Ultimately, such micro-studies of local networks might yield data that would allow predicting (with some degree of accuracy) the communication channels through which an educational innovation would flow from one faculty member or administrator to another.

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*A network consists of individuals or other units that are linked in a pattern through channels of communication (Rogers and Agarwala-Rogers, 1976a).

6. What is the relative effectiveness of various strategies for diffusing education innovations?

The IMPACT program approach is compared with an analysis of alternative strategies, such as (1) a low-cost, need-based information system like NEXUS, a project of the American Association for Higher Education funded by a grant from the Fund for the Improvement of Post-Secondary Education, and (2) a computer-centered dissemination network like CONDUIT, a National Science Foundation-sponsored organization of eight universities that currently exchange computer-based instructional materials. With their cooperation, these and other systems for encouraging educational innovation are studied as to whom they service and with what effects. Our intent is to identify particularly useful diffusion strategies, and, in a larger sense, to better understand the process of diffusion of educational innovations among university professors.

The main purpose of the present research is to determine how the IMPACT innovations continue to diffuse to university professors.

As such, the present research is the second year in an on-going investigation of in-process diffusion of innovations in higher education. Here we particularly focus on the interpersonal communication networks through which the IMPACT innovations diffuse.

DATA-GATHERING ACTIVITIES DURING 1975-76

In this section, we describe the process of gathering the main data-sets on which our present findings are based. Table 1 summarizes (1) the first six data-sets we gathered in 1974-75, and which are described in detail in Rogers and others (1975), and (2) the other nine data-sets that we gathered in 1975-76.

Data-Set #7: Secondary Receivers

Our first year's (1974-75) pilot study with 52 secondary receivers (Data-Set #6) suggested that much could be learned about the in-process aspects of diffusion (1) by gathering data from a larger sample of secondary receivers to obtain a more adequate knowledge base, (2) over a longer time period, when more secondary and tertiary diffusion would have occurred.

Our January-March, 1976 sample of secondary receivers' names came from the 1974-75 Phase 1 data-gathering, in which we asked all information requestors to nominate colleagues within and outside of their institution with whom they had talked about an IMPACT innovation.

The purpose of this telephone survey with secondary receivers was to determine the nature of interpersonal diffusion through which an innovation spreads from colleague to colleague within and outside institutional boundaries. We originally hoped to obtain approximately 100 telephone interviews with secondary receivers in 1976. Since we expected to

Table 1. Overview of the Various Data-Sets Gathered in 1974-75 and 1975-76.

Data-Set	Purpose of the Study	Outcome of the Study
Phase I		
#1. Requestor survey; mailed questionnaires; October, 1974 to February, 1975 (N=4,097 requests from 3,058 requestors).	To determine the personal and institutional characteristics of the requestors of the four IMPACT innovations, and how they were reached by the IMPACT program.	A 90 percent response (including telephone follow-ups with 52 non-respondents to the mail survey).
Phase II		
#2. Adopter interviews; October, 1974 to March, 1975 (N=137)	To determine the nature of the adoption and implementation process.	A 98 percent response from the 140 adopters.
#3. Information requestor telephone survey; February, 1975 (N=23)	To check the validity of our Phase I mailed questionnaire data with a small subsample of respondents.	Survey completed.
#4. Intend-to-adopt telephone survey; March, 1975 (N=20)	To obtain further information about their plans for adoption, which had been expressed in Data-Set #1 (above).	Survey completed; it provided the basis for the follow-up study of 199 intend-to-adopters in 1976 (see Data-Set #14).

#5. Non-adopters telephone survey; February, 1975 (N=30)	To determine reasons for not adopting an innovation after requesting information about it.	Survey completed.
Phase III		
#6. Pilot study of primary-secondary receiver pairs; March-April, 1975 (N=52)	To determine the nature of dyadic communication in the secondary diffusion of the IMPACT innovations.	Survey completed.
----- First year report of results completed in November, 1975 -----		
#7. Secondary receivers; telephone survey; January-March, 1976 (N=109)	To determine what could be learned (1) about secondary diffusion over a longer period of time from a larger sample (than in Phase III), and (2) the extent to which tertiary diffusion is occurring.	An 83 percent response from the 132 secondary receivers telephoned; 15 new adopters were found among them.
#8. Tertiary receivers; mailed questionnaire; April-May, 1976 (N=73)	To study the tertiary diffusion of the IMPACT innovations, and to determine the differences and similarities between secondary and tertiary receivers.	A 49 percent response from our sample of 150 tertiary receivers; seven new adopters were found among them.
#9. West Virginia University network study; 1974-76 (N=100)	To determine the nature of the local network for Guided Design, with special focus on its diffusion across disciplinary boundaries.	An 80 percent response from the primary and secondary receivers at WVU; 44 adopters* were found among them (30 were new adopters).

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*Fourteen adopters were known prior to the WVU network study, from the spontaneous adopters enumerated in 1974-75.

#10.	University of Wisconsin Center System network study; February-March, 1976; questionnaires to 16 persons at 13 community college counseling centers (N=15)	To determine the role that a grantee plays in the diffusion of an IMPACT innovation and the adoption within his/her own system. We conducted a "roster study" in that each respondent was asked his/her contacts about the innovation with all other 15 individuals in the network.	An 80 percent response rate was received.
#11.	Stockton State College network study; March, 1976 (N=26)	To determine the role that a spontaneous adopter plays in the diffusion of a computerized innovation, along with the help of a statewide educational computing network. All of the 26 respondents have access to the centralized computer network on which the TIPS program is running.	A 61 percent response rate was obtained; three new adopters were found.
#12.	Mailed questionnaires and personal interviews with 1975 grantees in January, 1976 (N=38)	To compare the 1975 with the 1974 grantees.	A 57 percent response from the 67 grantees in 1975.

#13.	Mailed questionnaires to follow-up the 1974 grantees in January, 1976 (N=35)	To follow-up as to the grantees' adoption status, and if they have made any modifications in the process of adoption and implementation.	A 62 percent response from the 56 1974 grantees.
#14.	Continued monitoring of the adoption of the four IMPACT innovations by means of a mailed questionnaire as to the adoption status of the 199 intend-to-adopt requestors originally identified in the 1974 Phase I survey (N=120)	To determine how many of the intend-to-adopt in 1974 progressed to adoption in 1975-76, so as to have a more accurate rate of spontaneous adoption.	A 60 percent response rate; we added 44 of the 199 intend-to-adopters to our list of "confirmed" adopters.
#15.	Continued monitoring of the adoption of the four IMPACT innovations by means of a mailed questionnaire to a possible 120 adopters who were mentioned by inventors in 1975-76 (N=96)	To determine their adoption status, and to update our files on adopters.	An 80 percent response rate; we added 43 adopters to our list of "confirmed" adopters.

be able to reach only about 75 percent of these secondary receivers by telephone, we planned to originally select a sample of 135 to 140 secondary receivers. Thus we selected a 5 percent sampling rate (1 in 20) of the 2,872 information requestors who responded in our Phase I.* This random-ordered sampling design yielded the names of only 106 secondary receivers (nominated by the 151 Phase I respondents). Since we were well short of our original target of 135-140 secondary receivers, we selected another random-ordered sample of Phase I requestors (a rate of 3 percent). This procedure yielded another 56 secondary receivers, nominated by 90 Phase I respondents. Forty-six percent of the 241 information requestors surveyed nominated at least one secondary receiver. So our two sub-samples, when merged, represent an eight-percent sampling rate of the Phase I requestors, yielding a sample of the names of 162 secondary receivers.

After eliminating (1) "overlapping" secondary receivers, who were already information requestors, or (2) secondary receivers who were already included in the Phase I, March, 1975 secondary receiver study, or (3) grantees, or (4) spontaneous adopters, from the 162 secondary receivers in the sample, 140 secondary receivers (nominated by 94 information requestors) remained.

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*As Table 1 shows, a total of 3,058 requestors responded in Phase I. However, data from only 2,872 requestors were available at the time we sampled for the 1976 secondary receiver study.

We eliminated eight secondary receiver/nominator pairs for which the secondary receivers were "entire faculty", "entire department", "UNESCO" (and hence out of the country) or "student", and one pair in which the nominator was not identified by name. These eliminations left a total of 132 secondary receivers, who had been nominated by requestors.

The percentage breakdown of our secondary receiver sample by IMPACT innovation is:

IMPACT Innovation	No. of Secondary Receivers	Percentage of All Secondary Receivers in Our Sample
1. EXPER SIM	16	12%
2. Guided Design	39	30%
3. TIPS	31	24%
4. Student-to-Student Counseling	46	34%
Totals	132	100%

Our questionnaire included essentially the same questions as in the 1974-75 Phase III questionnaire of secondary receivers, plus further questions to clarify the nature of the communication flow from the Phase I requestor (the nominator) to the nominated secondary receivers. The questionnaire was pre-tested in early January, 1976 with ten randomly-selected secondary receivers. The questionnaire seemed to be effective in obtaining meaningful answers and did not create response resistance. We then telephone interviewed 109 of the 132 secondary receivers, a response rate of 83 percent.

We began telephone interviews on January 15, 1976, calling each individual up to three times. After the third try, he or she was considered a non-respondent. The typical interview lasted about 10 to 15 minutes, and all the interviews were completed by mid-March, 1976. Two secondary receivers refused to be interviewed. Two more were eliminated because they were students. Eleven were eliminated because they could not be located (at least by the names and addresses provided by the nominator), four were eliminated because they had moved with no forwarding address, and eleven could not be contacted after three tries. Thus, after the above-mentioned 30 eliminations, we were able to reach 102 secondary receivers.

Of these 102 completed interviews, five respondents were multipley nominated as secondary receivers of two IMPACT innovaitons and one respondent was nominated as a secondary receiver of three IMPACT innovations, making a total number of 109 requestor-secondary receiver pairs (per innovation)*.

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*Since 102 of the secondary receivers were nominated for one innovation and 7 were nominated more than once, we use the secondary receiving units as the basis for our dyadic units of analysis.

Data-Set #8: Tertiary Receivers

The purpose of the mailed questionnaire* survey of tertiary receivers, who were nominated by the sample of 109 secondary receivers, was to explore further the nature of interpersonal diffusion.

Thirty-six percent of the 109 secondary receiving units in Data-Set #8 nominated 175 tertiary receivers with whom they had talked about an IMPACT innovation. The names of the 175 tertiary receivers were checked for overlap with individuals who were information requestors, spontaneous adopters, grantees, or secondary receivers. On this basis, 25 of the sample of 175 tertiary receivers were dropped, leaving 150 tertiary receiving units who were sent a mailed questionnaire in April, 1976. Their breakdown on the basis of the four IMPACT innovations is as follows.

IMPACT Innovation	No. of Tertiary Receivers	Percentage of All Tertiary Receivers in Our Sample
1. EXPER SIM	2	1%
2. Guided Design	38	25%
3. TIPS	19	13%
4. Student-to-Student Counseling	91	61%
Totals	150	100%

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* The decision to utilize a mailed questionnaire, rather than telephone interviews, was mainly on cost grounds. The lower response rate that we obtained, however, made us wish that we had used telephone interviews.

By mid-May, 1976, we had received 55 responses, and so we sent a follow-up questionnaire to the remaining 95 tertiary receivers. We were finally able to achieve a 49 percent response rate (from 73 of the 150 tertiary receivers).

Data-Set #9: West Virginia University Network

West Virginia University is located in Morgantown, West Virginia, where Professor Charles Wales, the inventor of Guided Design, is Director of Freshman Engineering. The Guided Design innovation, spearheaded by Professor Wales, has spread at WVU to such fields as philosophy, music, physics, nursing, geology, etc. We decided to study the local network of faculty members who either (1) were using Guided Design or have used it previously, or (2) who have heard about it and not yet decided to adopt. The inventor is very actively involved in dissemination of the innovation, as are several other faculty members at WVU. Diffusion at West Virginia University is aided by administrative sanctions and support, and has been helped by grants from external funding sources. In the past five years, there have been numerous publications, conferences, and seminars conducted about Guided Design involving faculty at West Virginia University, as well as at other universities. These activities give visibility and exposure to West Virginia University as an innovative institution in the field of higher education.

We wanted to investigate the role of an inventor/developer in a local diffusion network, to determine how it effects the rate of adoption of an innovation.

At West Virginia University, we identified approximately 115 faculty members in 26 disciplines with awareness-knowledge about Guided Design; 49 percent of them mentioned that they either contacted Professor Wales or heard him speak about Guided Design. There are 1,100 faculty members at West Virginia University; thus, about 10 percent of the total faculty have had some exposure to Guided Design.

We sent mailed questionnaires to 100 primary and secondary receivers of Guided Design in January-April, 1976. In addition, we personally interviewed 20 percent of the 100 known primary and secondary receivers between October, 1974 and December, 1975. We received a combined response rate of 80 percent from the 100 individuals.

Data-Set #10: University of Wisconsin Center System Network

The University of Wisconsin Center-Washington County is one of 15 colleges in a state community college system. It is located in West Bend, Wisconsin, and offers two years of undergraduate education.

We wished to determine the role that an IMPACT program grantee plays in a local diffusion network. We selected the Washington County Center where Professor Roland Baldwin had received an IMPACT grant in 1974 to implement Student-to-Student Counseling. We had hoped to observe an emerging network among the 14 community colleges in the University of Wisconsin Center system, which are faced with generally similar problems (1) of high student attrition rates, (2) changes in their institutional programs, and (3) concerns about the impersonal nature of higher education.

We contacted Professor Baldwin, the Director of Student Services, about a possible network "roster" study. He provided us with a name list of the other 13 directors of student services in the system. We sent a mailed questionnaire to these 13 directors of student services located on the 13 different campuses of the University of Wisconsin Center system. In addition, Professor Baldwin provided us with names of two of his colleagues at West Bend who were in student services work. We sent questionnaires to these 15 persons in March, 1976, and received an 80 percent response rate, after one follow-up, by April, 1976.

Data-Set #11: Stockton State College Network

Stockton State College is part of the New Jersey state college system. It is a relatively new, small liberal arts college located in Pomona, New Jersey. We chose Stockton State College for study as Professor Kenneth Tompkins, a spontaneous adopter, has played an important role in the diffusion of TIPS, with the help of a state-wide educational computing network, the New Jersey Educational Computer Network (NJECN). Professor Tompkins and the Director of NJECN advertised a TIPS workshop in the Network newsletter, which had a readership of about 6,000 in 1975. About 36 applications were received and 26 attended the workshop.

We sent a mailed questionnaire to 21 of the 26 workshop participants who were from various other colleges within the state of New Jersey. In addition, we personally interviewed five workshop participants who were faculty members at Stockton State College. The mailed questionnaire and personal interviews provided a combined response rate of 61 percent. We traveled to Pomona, New Jersey, in April, 1976, to discuss the innovation's diffusion with Professor Tompkins and to interview the five faculty members at Stockton State College.

Data-Set #12: 1975 Grantees

We learned that 67 IMPACT program grants were given by the Exxon Education Foundation in 1975 to implement one of the four IMPACT innovations. The grants, by innovations, are as follows:

IMPACT Innovation	No. of Grantees in 1975
1. EXPER SIM	12
2. Guided Design	19
3. TIPS	13
4. Student-to-Student Counseling	23
Total	67

We sent a mailed questionnaire to all but seven of the 1975 grantees (who were personally interviewed). The mailed questionnaires and personal interviews provided a combined response rate of 57 percent.

Our purpose was to collect data so as to compare the 1975 grantees with the 1974 grantees, and also to identify their secondary receivers.

Data-Set #13: Follow-Up with 1974 Grantees

In 1974, 56 applicants received a grant from the Exxon Education Foundation. We had contacted all 56 grantees in 1974. In 1975, we decided to send them a mailed questionnaire in order to follow-up as to their adoption status, and to determine if they had made modifications in one of the four IMPACT innovations in the process of its adoption and implementation.

We received a 62 percent response rate from the 56 grantees (six percent were interviewed personally for the second time). Thus, we report data from 35 of the 56 1974 grantees.

Data-Set #14: Continued Monitoring of Spontaneous Adopters Originally Identified in the 1974 Survey

During 1975-76 we continuously updated our file of "confirmed" adopters. Our sources of information were (1) the inventors, (2) the spontaneous adopters and grantees, (3) our case studies of the three networks, and (4) follow-ups with 1974-75 information requestors who had said they intent-to-adopt in the academic year 1975-76.

In our 1974-75 Phase I study, 199 individuals indicated that they had definite plans to adopt one of the four IMPACT innovations in the 1975-76 academic year. These 199 intend-to-adopt seemed to be potential adopters. In November, 1975, we mailed them a questionnaire inquiring about their present adoption status (and other details). We received a 60 percent response rate; among the 120 who returned the questionnaire, 44 (37 percent) were "confirmed" adopters.

Data-Set #15: Continued Monitoring of Spontaneous Adopters Mentioned by Inventors

From time to time during the 1975-76 year, we learned about new adopters from the four inventors; they met them at conferences or seminars or through correspondence or other contacts. Grantee questionnaires also indicated new adopters, and through our personal and telephone interviews, we learned of yet other new adopters. A total of 190 such individuals were identified during the 1975-76 year. We sent them a mailed questionnaire, or personally interviewed them. We found 43 new "confirmed" adopters (45 percent) among the 96 who responded.

SECONDARY AND TERTIARY DIFFUSION

Our research question #1 is: How do the IMPACT grantees, spontaneous adopters, and requestors diffuse the four innovations among their peers so as to create a corps of secondary receivers and tertiary receivers, and with what effect?

Of the six research questions addressed in the second year of our investigation (1975-76), we obtained the most detailed information regarding secondary and tertiary diffusion. A considerable amount of interpersonal diffusion of the four IMPACT innovations occurred from November, 1973, when the IMPACT program was launched by the Exxon Education Foundation, through our last data-gathering in the spring of 1976.

We seek to answer research question #1 by determining:

1. The number of information requests that were made through the end of 1975.

2. The diffusion of the four IMPACT innovations to the information requestors, to secondary receivers, to tertiary receivers, and to fourth-level receivers, at each succeeding level of interpersonal diffusion.

3. The rate of interpersonal diffusion of the four IMPACT innovations from the information requestors, to secondary receivers, to tertiary receivers, and to fourth-level receivers.

4. The rate of adoption at each of these succeeding levels of interpersonal diffusion.

5. The differences and similarities of dyadic pairs of individuals at each of these succeeding levels of interpersonal diffusion.

6. The differences and similarities of IMPACT program grantees in 1974 versus 1975.

7. Ratios of information requestors, grant proposals, and adoptors, and how these rates change over time.

Rate of Information Requests through 1975

We first look at the rate at which individuals requested detailed information about the four IMPACT innovations from the inventors and sub-inventors. We obtained these data (1) from a mailed questionnaire that we sent in November, 1974 to all requestors, whose names were provided by the four inventors and one sub-inventor (Data-Set #1 in Table 1), and (2) from the records of the inventors for the period after November, 1974.

Table 2 shows that a considerable number of information requests continued to be made in late 1974 and 1975, after our mailed questionnaire (Data-Set #1) was sent. But the average number of requests per

Table 2. Number of Information Requests for the Four IMPACT Innovations, by Time Period

Time of Request	EXPER SIM	Guided Design	TIPS	Student-to-Student Counseling	All Four Innovations Combined	Average per Month
	Number of Information Requests					
1. Prior to launching of the IMPACT program in November, 1973*	196	247	158	218	819	---
2. November, 1973 through October, 1974*	696	927	721	934	3, 278	273
3. November, 1974 through December, 1975**	873	931	388	784	2, 976	213
Totals	1, 765	2, 105	1, 267	1, 936	7, 073	---

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* These data were obtained from the mailed questionnaire to information requests in November, 1974 (Data-Set #1 in Table 1).

** These data were provided to us by the four inventors and one sub-inventor of the four IMPACT innovations.

month dropped somewhat from 273 in 1973-74, to 213 in 1974-75 (a 22 percent decrease).

The month-by-month cumulative rate of information requests could only be computed for Guided Design, as the date of each request during 1974-75 could not be obtained for the other three IMPACT innovations. Figure 1 shows that this curve of the cumulative number of information requests for Guided Design is generally S-shaped, without much evidence of leveling-out, as had been expected in late 1974 on the basis of data available at that time (Rogers and others, 1975). If month-by-month data were available for the other three innovations, their cumulative curves would follow a generally similar shape.

We conclude that the number of requests for the four IMPACT innovations follows an S-shaped curve when plotted cumulatively over time, without much evidence of leveling-out, although the average number of requests per month dropped somewhat (from 273 in 1973-74, to 213 in 1974-75). An estimated 7,073 information requests have been made for the four IMPACT innovations during the first 26 months of the IMPACT program (through December, 1975). The S-shaped curve has not begun to level out at the top.

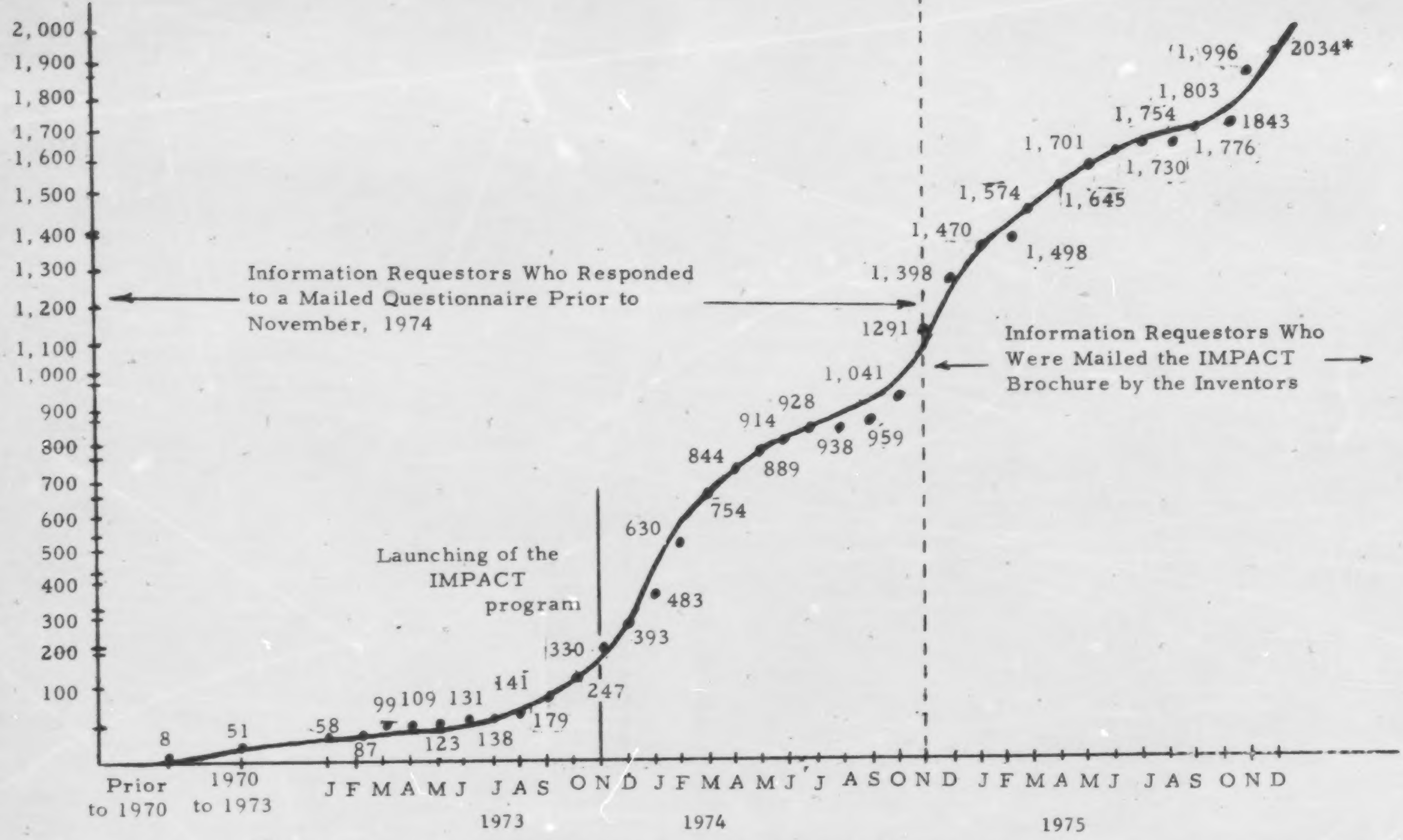

Figure 1. Cumulative Number of Information Requestors of Guided Design

* This total of 2,034 is less than the 2,105 shown in Table 2 because (1) of the non-response to our mailed questionnaire and (2) of the lack of a date of request for some respondents

Diffusion of the Four IMPACT Innovations to Information Requestors, Secondary Receivers, and Tertiary Receivers

Here we look at how information requestors, secondary receivers, and tertiary receivers obtained information about the four IMPACT innovations.

A source is the originator of a message, while the receiver is the individual intended to be the destination of a source's message(s). A message is a stimulus about an idea that the source transmits to the receiver. The channel is the means by which a message gets from a source to a receiver; channels physically transmit messages. The two main categories of communication channels are (1) mass media channels, and (2) interpersonal channels. Mass media channels are all those channels involving a mass medium such as a newspaper, magazine, radio, television, etc., which enable a source of one or a few individuals to reach an audience of many. Interpersonal channels are those channels involving face-to-face information exchange between a source and a receiver.

In this section we are mainly interested in how messages about the four IMPACT innovations were communicated from sources to receivers. Table 3 indicates that 37 percent of the information requestors asked for detailed information about more than one of the four IMPACT innovations,

Table 3. Individual and Institutional Characteristics of Information Requestors, Secondary Receivers, and Tertiary Receivers*

Individual and Institutional Characteristics	Information Requestors (N=3,698)	Secondary Receivers (N=109)	Tertiary Receivers (N=73)
1. Percentage requesting more than one of the four IMPACT innovations	37%	0	0
2. Average number of years at the present institution	7 years	9 years	8 years
3. Number of seven teaching innovations** adopted	3.1	3.5	3.1
4. Percentage with doctorate degree	64%	61%	61%
5. Percentage who are administrators	65%	39%	43%
6. Weight given to teaching in the perceived reward structure of the institution (out of 100 total points)	80 points	71 points	67 points
7. Age in years	40	41	40
8. Total student enrollment at the individual's institution	9,330	8,073	8,489
9. Gourman academic ranking for the individual's institution	376	420	419

*The data presented here come from Data-Set #1 (October, 1974 to February, 1975), Data-Set #7 (January-March, 1976), and Data-Set #8 (April-May, 1976). The variance for these variables for each sample as shown in Table A-1 (Appendix).

**The seven teaching innovations were: Instructional TV or videotape; overhead projector; simulation, instructional games, and/or role-playing, contract grading; computer-assisted instruction; programmed instruction, and/or other printed self-instructional materials; and small group discussion.

but none of the secondary and tertiary receivers (who later became nominators of other individuals in the interpersonal diffusion process) ever requested information about more than one innovation from the inventors.

Table 3 shows the three sets of respondents (requestors, secondary receivers, and tertiary receivers) are generally similar in their individual and institutional characteristics. One exception is the 65 percent of the information requestors who were administrators, as compared to only 39 percent of the secondary receivers, and 43 percent of the tertiary receivers who were administrators. This difference may be due to the fact that the IMPACT brochures were originally mailed by the Exxon Education Foundation especially to college administrators, rather than to individual faculty members.

Table 4 shows the IMPACT brochure from the Exxon Education Foundation was the most frequently mentioned source/channel of awareness-knowledge for information requestors, secondary receivers, and tertiary receivers.

The other mass media channel, journal articles (written mostly by the inventors and occasionally by adopters about their experience with an innovation), were much less frequently mentioned as a source/channel of awareness-knowledge by all three sets of respondents, but secondary receivers mentioned journal articles more frequently than the other two groups.

Table 4. Mass Media and Interpersonal Source/Channels of Awareness-Knowledge about the Four IMPACT Innovations for Information Requestors, Secondary Receivers, and Tertiary Receivers.

First Source/Channel of Information about the Four IMPACT Innovations	Information Requestors (N=3, 586)*	Secondary Receivers (N=75)**	Tertiary Receivers (N=34)***
I. Mass Media Channels	59%	45%	41%
A. IMPACT brochure	(50%)	(29%)	(41%)
B. Journal articles	(9%)	(16%)	(0%)
II. Interpersonal Channels	39%	32%	47%
A. Administrators (e. g. , dept. chairman, dean, vice president, R&D administrators, etc.)	(22%)	(7%)	(23%)
B. Colleagues in the same field or other fields	(9%)	(4%)	(9%)
C. Professional conference	(6%)	(16%)	(6%)
D. Inventor of the innovation	(2%)	(5%)	(9%)
III. Other Sources	2%	23%	12%
Total	100%	100%	100%

---

* Of the 3,689 responding requestors, 112 (3 percent) did not answer the present question. Data were gathered from October, 1974 to February, 1975.

** Of the 109 secondary receivers, 34 (31 percent) did not answer present question. Data were gathered from January-March, 1976.

*** Of the 73 tertiary receivers, 39 (53 percent) did not answer the present question. Data were tathered from March-April, 1976.

Among the interpersonal channels, administrators were mentioned by 22 percent of the information requestors and by 23 percent of the tertiary receivers. Secondary receivers did not learn about the four IMPACT innovations from administrators as often (7 percent).

Because of the great importance of the IMPACT brochure in creating awareness-knowledge about the IMPACT innovations, we asked our respondents to indicate how they obtained the IMPACT brochure. Table 5 shows that the information requestors most frequently reported direct mailings from the Exxon Education Foundation (48 percent), followed by administrators and colleagues who passed the IMPACT brochures along to them (36 percent). The importance of these two sources is reversed for the secondary and tertiary receivers as interpersonal channels are more important in leading to acquisition of the IMPACT brochure. About 52 percent of the tertiary receivers had never seen an IMPACT brochure.

These findings regarding awareness-knowledge about the four innovations, and the IMPACT brochure, suggest that mass media source/channels are relatively more important in creating awareness-knowledge in the early stages of the diffusion process (such as for information requestors), but interpersonal channels play a somewhat more important role at later stages in the diffusion process (such as for secondary and tertiary receivers).

Table 5. Mass Media and Interpersonal Channels of Communication through which the Exxon Brochure was Received by Information Requestors, Secondary Receivers, and Tertiary Receivers.

Channels from which the Exxon Brochure Was Received	Information Requestors (N=3, 567) *	Secondary Receivers (N=103)**	Tertiary Receivers (N=54)***
I. Mass Media Channels			
A. Directly through the mail from the Exxon Education Foundation	48%	43%	20%
II. Interpersonal Channels	46%	55%	28%
A. Administrators (e. g., dean, director of counseling center, chairman, etc.), or colleagues	(36%)	(48%)	(26%)
B. Research administration officials at respondent's institution	(8%)	(4%)	(2%)
C. Inventor	(2%)	(3%)	--
III. Self-Initiated Request to Exxon Education Foundation	1%	---	---
IV. Did not receive IMPACT Brochure	5%	2%	52%
Totals	100%	100%	100%

---

* Of the 3,698 responding requests, 131 (4 percent) did not answer the present question. Data were gathered from October, 1974 - February, 1975.

** Of the 109 secondary receivers, 6 (5 percent) did not answer the present question. Data were gathered from January-March, 1976.

*** Of the 73 tertiary receivers, 19 (26 percent) did not answer the present question. Data were gathered from March-April, 1976.

Rate of Interpersonal Diffusion of the Four IMPACT Innovations

Here we look at the interpersonal communication of the four IMPACT innovations from (1) the information requestors (in our Data-Set #1 in Table 1), (2) to secondary receivers (Data-Set #7), (3) to tertiary receivers (Data-Set #8), (4) to fourth-level receivers, who were named by the sample of tertiary receivers.

Figure 2 shows that the average responding request reported talking to 0.743 secondary receivers.* The average secondary receiver talks to 1.370 tertiary receivers.** The average tertiary receiver has relatively little interpersonal communication with colleagues about the four IMPACT innovations. Only 2 percent of the tertiary receivers reported any communication with colleagues about an IMPACT innovation, and the average tertiary receiver contacted only 0.360 fourth-level receivers.***

So the rate of interpersonal diffusion about the four IMPACT innovations (as indicated by the average number of non-overlapping individuals contacted) is greater for the secondary receivers than for the information requests, and lowest for the tertiary receivers.

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* Who did not overlap with any of the information requestors.

** Who did not overlap with any of the information requestors or secondary receivers.

*** Who did not overlap with any of the information requestors, secondary receivers, or tertiary receivers.

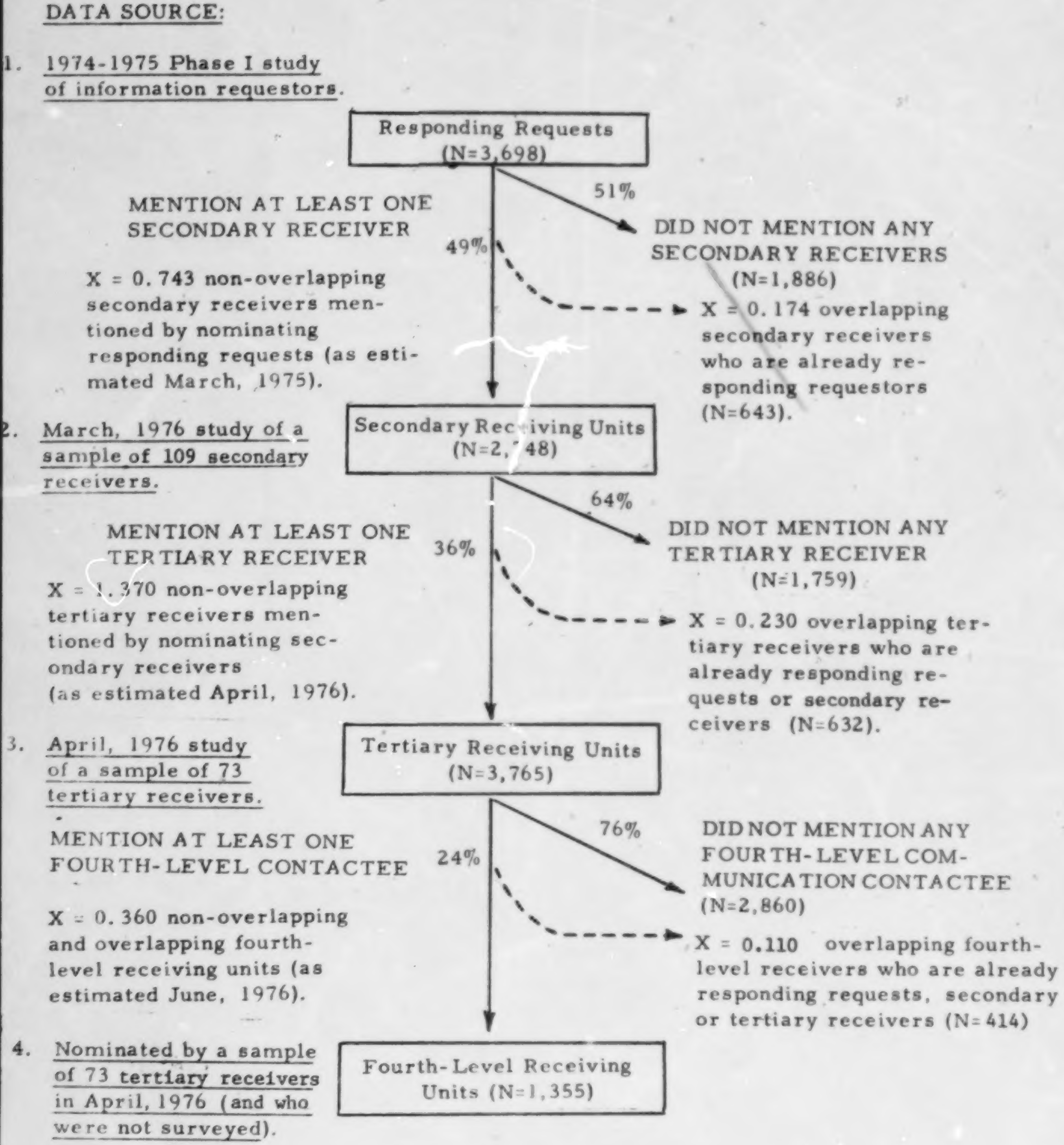
DATA SOURCE:
1. 1974-1975 Phase I study of information requestors.
Responding Requests (N=3,698)
51%
MENTION AT LEAST ONE SECONDARY RECEIVER
49%
DID NOT MENTION ANY SECONDARY RECEIVERS (N=1,886)
X = 0.743 non-overlapping secondary receivers mentioned by nominating responding requests (as estimated March, 1975).
X = 0.174 overlapping secondary receivers who are already responding requestors (N=643).
2. March, 1976 study of a sample of 109 secondary receivers.
Secondary Receiving Units (N=2,748)
64%
MENTION AT LEAST ONE TERTIARY RECEIVER
36%
DID NOT MENTION ANY TERTIARY RECEIVER (N=1,759)
X = 1.370 non-overlapping tertiary receivers mentioned by nominating secondary receivers (as estimated April, 1976).
X = 0.230 overlapping tertiary receivers who are already responding requests or secondary receivers (N=632).
3. April, 1976 study of a sample of 73 tertiary receivers.
Tertiary Receiving Units (N=3,765)
76%
MENTION AT LEAST ONE FOURTH-LEVEL CONTACTEE
24%
DID NOT MENTION ANY FOURTH-LEVEL COMMUNICATION CONTACTEE (N=2,860)
X = 0.360 non-overlapping and overlapping fourth-level receiving units (as estimated June, 1976).
X = 0.110 overlapping fourth-level receivers who are already responding requests, secondary or tertiary receivers (N=414)
4. Nominated by a sample of 73 tertiary receivers in April, 1976 (and who were not surveyed).
Fourth-Level Receiving Units (N=1,355)

Figure 2. The In-Process Diffusion of the IMPACT Innovations among University Professors as Reported through Average Numbers of Secondary, Tertiary, and Fourth-Level Communication Contacts with Colleagues Within and Outside Institutions.

Level of Interpersonal Diffusion	Average Number of Non-Overlapping Individuals Contacted about the IMPACT Innovations
1. Responding information requests	0. 743 secondary receivers
2. Secondary receivers	1. 370 tertiary receivers
3. Tertiary receivers	0. 360 fourth-level receivers

Perhaps this lower rate of interpersonal diffusion about the IMPACT innovations for the tertiary receivers is due to the fact that they have had a shorter period of time to discuss the IMPACT innovations with their peers, than have the information requestors or the secondary receivers. Or perhaps the tertiary receivers possess less detailed information about the IMPACT innovations (as a result of learning about them third-hand)*, or are less enthused about them.

Figure 2 also shows the percent of respondents at each of the levels of interpersonal diffusion that mentioned talking about an IMPACT innovation with at least one receiver:

Level of Interpersonal Diffusion	Percent of Respondents who Reported Talking about an IMPACT Innovation with at Least One Receiver
1. Responding information requestors	49%
2. Secondary receivers	36%
3. Tertiary receivers	24%

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*We have earlier noted that 52 percent of the tertiary receivers have not seen the IMPACT brochure about the four IMPACT innovations. This non-exposure may have added to the communication inactivity of the tertiary receivers, in that they were less fully informed about the four innovations.

So the rate of interpersonal activity in diffusing the four IMPACT innovations (as indicated by talking with at least one receiver) decreases linearly from information requestors to secondary receivers to tertiary receivers.[*]

A smaller portion of the secondary receivers than of the information requestors (36 percent as compared to 49 percent) talked to at least one receiver about an IMPACT innovation, but these 36 percent of the secondary receivers talked to about twice as many receivers as to the information requestors (an average of 1.370 receivers, as compared to 0.743 receivers).

Figure 2 also shows a certain degree of circular overlapping in the interpersonal diffusion of the four IMPACT innovations. An estimated total of 11,566 different individuals have learned about the four IMPACT innovations, with 7,868 (68 percent) of these learning via interpersonal communication channels from the 3,698 information requestors.[**] In addition to these 7,868 different (non-overlapping) receivers, 1,689 "overlapping" contacts occurred. An example would be a secondary receiver who reported talking with another secondary receiver about an IMPACT innovation. These 1,689 overlapping receivers represent about 17 percent of all the 9,557 receivers named at the first three levels of interpersonal diffusion; such overlapping contacts may represent a type of reinforcement and encouragement for adoption, even though they do not represent the creation of additional new knowers about the four IMPACT innovations.

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[*] We analyzed the personal and institutional characteristics of the information requestors who named at least one secondary receiver versus those information requestors who did not; there were very few differences at this aggregate level (however, there is a general tendency for information requestor-secondary receiver homophily on these variables, as we show later.

[**] Actually, another 2,976 information requests were made from November, 1974 through December, 1975 (Table 2), but could not be included in the calculations here. So by January, 1976, 26 months after the IMPACT program was launched, there were at least 14,542 different individuals aware of the four innovations (11,566 plus 2,976).

Until now, we have implied that all the interpersonal diffusion summarized in Figure 2 reached receivers who had not previously known about the IMPACT innovation. On the contrary, we found that most such receivers had already heard about the IMPACT innovation from other communication sources. This finding suggests that initiation of the interpersonal communication may often have been on the part of the receiver in the dyad (rather than the source) who already was aware of the IMPACT innovation and then sought further information about it. The extent to which interpersonal secondary diffusion and tertiary diffusion create awareness-knowledge of the IMPACT innovation among individuals (who are not already aware from other source/channels) is as follows:

1. Secondary diffusion.

(a) Secondary receivers who first heard of an IMPACT innovation from the primary information requestor who nominated them	23%
(b) Secondary receivers who first heard of an IMPACT innovation from the IMPACT brochure, professional meetings, journal articles, and other sources/channels	77%
Total	100%

2. Tertiary diffusion.

(a) Tertiary receivers who first heard of an IMPACT innovation from the secondary receiver who nominated them	12%
(b) Tertiary receivers who first heard of an IMPACT innovation from the IMPACT brochure, professional meetings, journal articles, and other sources/channels	88%
Total	100%

So the number of new knowers about the four IMPACT innovations created by interpersonal diffusion at each level is estimated to be:

Level of Interpersonal Diffusion	First Heard about an IMPACT Innovation	Already Heard about an IMPACT Innovation	Total
1. Secondary receivers	632	2,116	2,748
2. Tertiary receivers	452	3,313	3,765
Totals	1,084	5,429	6,513

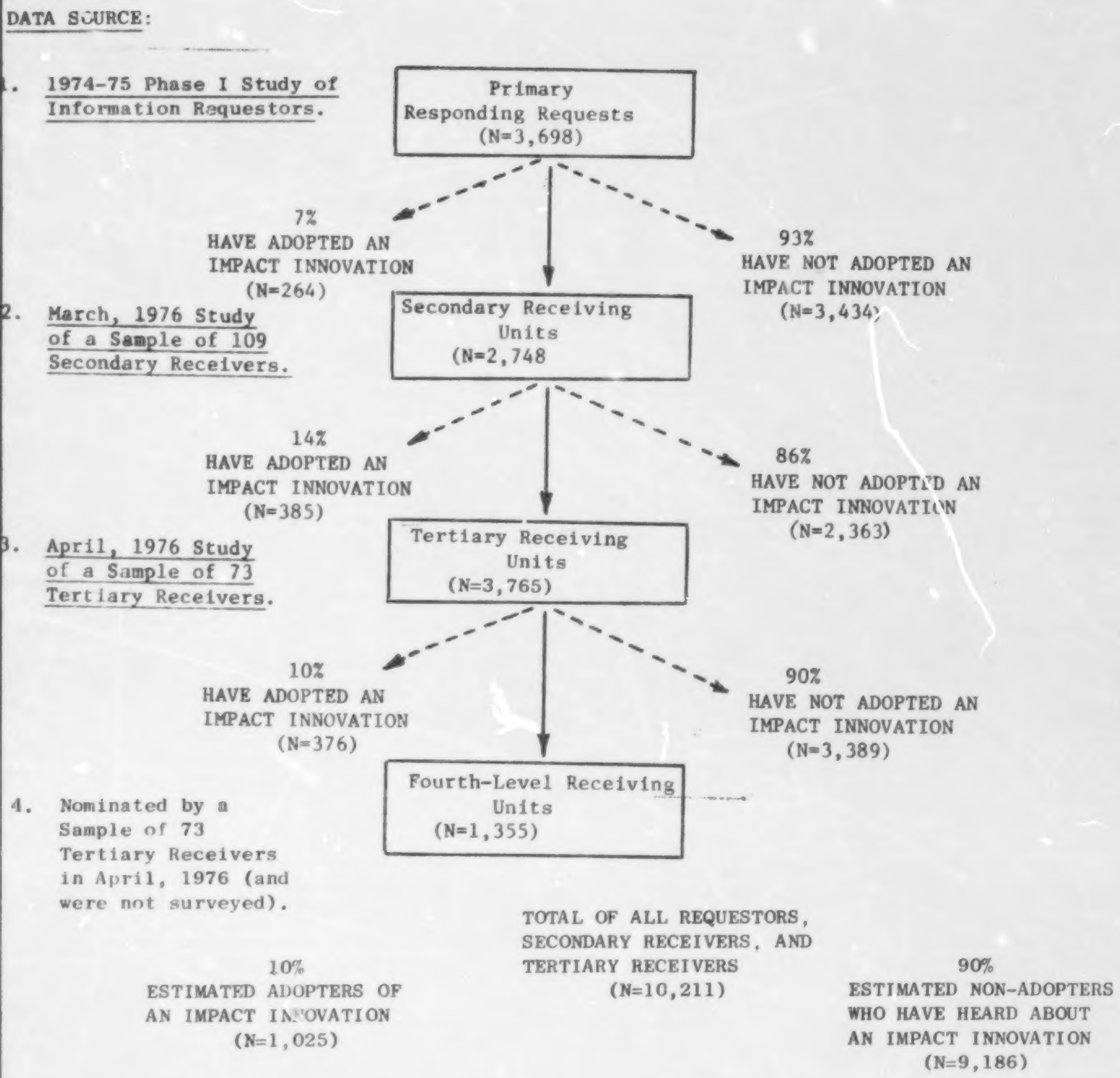
The 1,084 new knowers through interpersonal diffusion is much less impressive than the 6,513 total secondary and tertiary receivers. Most of the secondary and tertiary receivers (83 percent) reached by interpersonal diffusion from the information requestors and secondary receivers, respectively, had already heard about the IMPACT innovation from other sources/channels. But we know from prior research on the diffusion of innovations that interpersonal contact is often uniquely able to motivate individuals to adopt a new idea, even when a mass communication channel has already created awareness-knowledge of the innovation (Rogers with Shoemaker, 1971). So the 5,429 "redundant" contacts (where the secondary or tertiary receivers already knew about the IMPACT innovation) through interpersonal diffusion may still be important in clinching adoption decisions.

Rate of Adoption of the Four IMPACT Innovations by Level of Interpersonal Diffusion

Figure 3 shows that 10 percent of the 10,211 individuals who learned about one of the four IMPACT innovations as information requestors, secondary receivers, or as tertiary receivers have adopted. The rate of adoption is highest for secondary receivers (14 percent), lower for tertiary receivers (10 percent), and lowest for information requestors (7 percent).

Table 6 shows that the adopters of an innovation are more actively involved in the interpersonal diffusion of the four IMPACT innovations than are the non-adopters, with the intend-to-adopt at an intermediate level of interpersonal diffusion activity.

Twenty-eight months after the launching of the IMPACT program (in November, 1973), there are 1,025 adopters (by our estimate) out of which 487 (48 percent) are "confirmed adopters", whose names are



DATA SOURCE:

1974-75 Phase I Study of Information Requestors.

2. March, 1976 Study of a Sample of 109 Secondary Receivers.

3. April, 1976 Study of a Sample of 73 Tertiary Receivers.

4. Nominated by a Sample of 73 Tertiary Receivers in April, 1976 (and were not surveyed).

Primary Responding Requests (N=3,698)
7% HAVE ADOPTED AN IMPACT INNOVATION (N=264)
93% HAVE NOT ADOPTED AN IMPACT INNOVATION (N=3,434)
Secondary Receiving Units (N=2,748
14% HAVE ADOPTED AN IMPACT INNOVATION (N=385)
86% HAVE NOT ADOPTED AN IMPACT INNOVATION (N=2,363)
Tertiary Receiving Units (N=3,765)
10% HAVE ADOPTED AN IMPACT INNOVATION (N=376)
90% HAVE NOT ADOPTED AN IMPACT INNOVATION (N=3,389)
Fourth-Level Receiving Units (N=1,355)
TOTAL OF ALL REQUESTORS, SECONDARY RECEIVERS, AND TERTIARY RECEIVERS (N=10,211)
10% ESTIMATED ADOPTERS OF AN IMPACT INNOVATION (N=1,025)
90% ESTIMATED NON-ADOPTERS WHO HAVE HEARD ABOUT AN IMPACT INNOVATION (N=9,186)

Figure 3. Estimated Rates of Adoption of the Four IMPACT innovations by Level of Interpersonal Diffusion.*

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*The data-sets on which each of the estimated number of adopters is based are detailed in Table 1: Information Requestors (Data-Set #1), Secondary Receivers (Data-Set #7), and Tertiary Receivers (Data-Set #8). Note that these data were gathered at different times and represent varying rates of response; hence the quality of our estimates varies for these three data-sets.

Table 6. Number of Communication Contacts (both overlapping and non-overlapping) Reported by the Information Requestors, Secondary Receivers, and Tertiary Receivers, by their Adoption Status.

Adoption Status of the Respondent	Average Number of Communication Contacts		
	Information Requestors (N=3, 613)*	Secondary Receivers (N=103)**	Tertiary Receivers (N=67)***
1. Have adopted one of the four IMPACT innovations	$\bar{X} = 2.08$ (N = 264)	$\bar{X} = 4.27$ (N = 15)	$\bar{X} = 1.43$ (N = 7)
2. Intend-to-adopt an IMPACT innovation	$\bar{X} = 1.27$ (N = 219)	$\bar{X} = 2.83$ (N = 6)	$\bar{X} = 2.00$ (N = 2)
3. Have no plans to adopt an IMPACT innovation	$\bar{X} = 0.80$ (N = 3,130)	$\bar{X} = 1.46$ (N = 82)	$\bar{X} = 0.34$ (N = 58)
Total number of communication contacts	$\bar{X} = 0.92$ (N = 3,613)	$\bar{X} = 1.70$ (N = 103)	$\bar{X} = 0.51$ (N = 67)

* Of the 3,698 primary responding requestors, 85 (2 percent) did not provide data on their adoption status (Data-Set #1 in Table 1).

** Of the 109 secondary receiving units, 6 (6 percent) did not provide data on their adoption status (Data-Set #7 in Table 1).

*** Of the 73 tertiary receiving units, 6 (8 percent) did not provide data on their adoption status (Data-Set #8 in Table 1).

in our files (provided by a variety of sources, which we detail later). Among the estimated 9,186 non-adopters who have heard about an IMPACT innovation, we obviously expect that future adoption will take place.*

A number of respondents have definite plans to adopt an IMPACT innovation, but were not using the innovation at the time we gathered data from them. There were 199 "intend-to-adopt"** respondents in our 1974-75 study of information requestors. We followed up these 199 "intend-to-adopt" in December, 1975, by mailing them a questionnaire (this is Data-Set #14 in Table 1). We received a 60 percent response rate; among the 120 who returned the questionnaire, 44 (37 percent were new adopters. So we estimate that 74 of the 199 intend-to-adopt have actually adopted.

We also estimate there are 471 individuals who "intend-to-adopt" among the 10,211 estimated knowers of the four IMPACT innovations (Figure 3). Out of these 471 intend-to-adopt, an estimated 174 individuals may have adopted (using the estimated 37 percent rate of adoption obtained for the information requestors, as detailed above).

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* As well as among the 2,976 information requestors from November, 1974 through December, 1975 (Table 2) that could not be included in the present estimates.

** "Intend-to-adopt" are those individuals who indicated that they have definite plans to implement an IMPACT innovation in the near future, usually within the academic year in which we gathered data from them.

Level of Interpersonal Diffusion	Intend-to-Adopt Estimated Percent	Intend-to-Adopt Estimated Number	Estimated No. of Adopters
1. Information requestors (N = 3, 698)	5.38%	199	74
2. Secondary receivers (N = 2, 748)	5.82%	160	59
3. Tertiary receivers (N = 3, 765)	2.98%	112	41
Totals		471	174

So of the 1,025 total estimated adopters, we have 487 "confirmed adopters" (of whom 123 are IMPACT program grantees through 1975), and 538 are yet unconfirmed. Of these 538, we estimate that 174 are "intend-to-adopt" who have adopted. Of the remaining 364 estimated adopters, some may also be "intend-to-adopt" (297, or 471 minus 174, are possibly in this category), and the remainder are other estimated adopters that we could not confirm.

Obviously, as the chains of interpersonal diffusion spread from inventors to information requestors to secondary receivers to tertiary receivers to fourth-level receivers, it is increasingly difficult to monitor accurately the rate of adoption that is occurring, especially as we gathered only sample data from the secondary receivers and tertiary receivers, and none from the fourth-level receivers. This methodological cavaet must be kept in mind regarding our data about rates of adoption by level of interpersonal diffusion.

We conclude that diffusion of the four IMPACT innovations has caught on. Twenty-eight months since the IMPACT program was launched, there are 10,211 (by May, 1976) individuals who, by our estimates, have heard about an IMPACT innovation.* Out of these 10,211, 734 persons have submitted a proposal for an implementation grant (by February, 1976), and 123 have received a grant to adopt an IMPACT innovation (by December, 1975). In addition, 364 individuals are confirmed (spontaneous) adopters of an innovation without an IMPACT grant. The important role played by spontaneous adopters in the interpersonal diffusion of the four IMPACT innovations indicates that the innovations are salient and relevant to the adopters, and that a need exists for the innovations.

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*Plus an additional 2,976 information requestors from November, 1974 through December, 1975 (Table 2) that are not included in the analysis upon which the present estimates are based.

Differences and Similarities of Dyadic Individuals by Level of Interpersonal Diffusion

Here we look (1) at the differences and similarities in personal and institutional characteristics between the members of requestor-secondary receiver dyads, (2) these same differences and similarities for the individual members of secondary-tertiary receiver dyads, (3) how such dyadic communication is perceived by the requestors, secondary receivers, and tertiary receivers who are involved, and (4) how these dyadic characteristics and perceptions seem to affect the level of interpersonal diffusion about the four IMPACT innovations.

Members of Requestor-Secondary Receiver Dyads

As we noted previously in this report, we telephone-interviewed 109 secondary receivers who were "nominated" by 109 information requestors as the communication contactee with whom they had discussed an IMPACT innovation (Data-Set #7). Thus there are 109 dyadic pairs of requestors and secondary receivers in the present analysis. Table 7 indicates that primary nominators were almost twice as likely to request information about more than one innovation than the secondary receivers who nominated them. The primary requestors who nominated secondary receivers had been at their present institutions for less than six years, as compared to their nominees who have been at their present institutions for more than eight years.*

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*The number of years at the present institution may be related to knowing more colleagues within and outside of the respondent's department on the same campus and to being more embedded in their environment.

Table 7. Individual and Institutional Characteristics of the Members of Information Requestor-Secondary Receiver Communication Dyads Who Discussed the Four IMPACT Innovations.*

Individual and Institutional Characteristics of Dyadic Members	Information Requestors "Nominaters" (N=109)	Secondary Receivers "Nominateds" (N=109)
1. Percentage requesting more than one of the four IMPACT innovations	28%	16%
2. Average number of years at present institution	5.6 years	8.7 years
3. Number of seven teaching innovations adopted	3.0	3.5
4. Percentage with a doctorate degree	62%	62%
5. Percentage who are administrators	61%	41%
6. Weight given to teaching in the perceived reward structure (out of 100 total points)	81 points	71 points
7. Age in years	38	41
8. Total student enrollment at the individual's institution	7,821	8,073
9. Gourman academic ranking for the individual's institution	422	420

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*The variance for the individual and institutional variables is provided in Table A-1 (Appendix).

Members of Secondary-Tertiary Receiver Pairs

As we explained previously, there are 73 pairs of secondary-tertiary receivers in our study (Data-Set #8 in Table 1). None of the dyads requested information about more than one IMPACT innovation (Table 8), and the individual members of secondary-tertiary receiver dyads generally have rather similar characteristics, at least in the aggregate.

The Nature of Interpersonal Communication

We asked a series of questions about how secondary and tertiary receivers who were nominated perceived their communication about the IMPACT innovations with their nominees (primary requestors and secondary receivers, respectively), which is a way of looking at interpersonal diffusion from the point of view of the receivers.

A majority of the secondary receivers who were nominated by primary requestors (69 percent) heard about the IMPACT innovations through the IMPACT brochure and via journal articles written by inventors and/or adopters. About 49 percent of the tertiary receivers mentioned that they heard about the IMPACT innovations through interpersonal channels/sources such as administrators, colleagues at

Table 8. Individual and Institutional Characteristics of the Members of Secondary Receiver-Tertiary Receiver Communication Dyads Who Discussed the Four IMPACT Innovations.*

Individual and Institutional Characteristics of Dyadic Members	Secondary Receivers "Nominaters" (N=73)	Tertiary Receivers "Nominateds" (N=73)
1. Percentage requesting more than one of the four IMPACT innovations	0	0
2. Average number of years at present institution	8.6 years	8.3 years
3. Number of seven teaching innovations adopted	4.4	3.1
4. Percentage with a doctorate degree	49%	61%
5. Percentage who are administrators	46%	43%
6. Weight given to teaching in the perceived reward structure (out of 100 total points)	68 points	67 points
7. Age in years	40	40
8. Total student enrollment at the individual's institution	8,073	8,489
9. Gourman academic ranking for the individual's instution	446	419

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*The variance for the individual and institutional variables is provided in Table A-1 (Appendix).

conferences, etc.* Recall of the interpersonal contact with the nominator was reported by 60 percent of the secondary receivers and 49 percent of the tertiary receivers. Seventy-seven percent of the secondary receivers and 56 percent of the tertiary receivers reported that their communication contact with their nominators took place at meetings or at talks by the nominator which they attended, at casual chance meetings with the nominator, at departmental-level meetings with the nominator, or through correspondence or over the phone. The majority of interpersonal communication about the four IMPACT innovations is between colleagues in the same department or within the same campus.

Fifty-four percent of the secondary receivers and 47 percent of the tertiary receivers said that the majority of the interpersonal communication with their nominees concerned a general description of the IMPACT innovation; there was little emphasis on the successful experience that the nominator might have had in use of the IMPACT innovation. Despite the volume of interpersonal communication about the four IMPACT innovations, we find that very few nominators urged their nominees to adopt the innovation (only 7 percent of the secondary receivers and 15 percent of the tertiary receivers). It seems there is a professional norm that faculty members do not discuss their teaching/counseling methods with peers, much less advise or influence their colleagues on such matters.

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* The response rate for the question about sources/channels of awareness-knowledge about the IMPACT innovations was very small; only 37 percent for the secondary receivers and 14 percent of the tertiary receivers responded to this question. Despite such limited data, the present findings support the earlier finding that mass media channels/sources are more important at the earlier stages of the innovation-decision process, and that interpersonal channels/sources are more important at later stages.

Characteristics of Dyadic Partners

We asked the nominators (1) in the requestor-secondary receiver dyads, and (2) in the secondary-tertiary receiver dyads, a set of three sociometric questions. They were asked to nominate the individuals with whom they had talked about the four IMPACT innovations who were (1) within their own department, (2) within the same university but in a different department, and (3) at a different campus. Table 9 indicates:

1. That 49 percent of the primary requestors discussed one of the IMPACT innovations with at least one individual; most of these communication contacts occurred within the same department.

2. The secondary receivers' communication contacts about the IMPACT innovations were within the same department or in a different department but on the same campus.

3. About 24 percent of tertiary receivers talked to at least one fourth-level receiver; most of these communication contacts were within the same department or at least within the same campus.

Table 9. Percentage of Primary Requestors, Secondary Receivers, and Tertiary Receivers Who Talked to at Least One Individual about an IMPACT Innovation.*

	Percentage Who Talked to at Least One Individual About an IMPACT Innovation		
Location of Individuals with whom the Innovation was Discussed	Primary Requestors (N=3,698)	Secondary Receivers (N=109)	Tertiary Receivers (N=73)
1. Within the same department	33%	26%	18%
2. Outside of the respondent's department, but at the same institution	25%	28%	11%
3. At other institutions	6%	17%	5%
Any of the above	49%	36 %	24%

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*The sources of these data are: Primary Requestors (Data-Set #1 in Table 1), Secondary Receivers (Data-Set #7 in Table 1), and Tertiary Receivers (Data-Set #8 in Table 1).

These location-bound communication patterns (within the same department or institution) lead to a high degree of homophily between the pairs of individuals regarding the institutional characteristics of the nominators and nominees.*

	Percentage of All Pairs that Are Homophilous (Similar)	
Institutional Characteristics	Primary-Secondary Receiver Pairs (N=109)	Tertiary-Secondary Receiver Pairs (N=73)
1. Size of the institution	89%	90%
2. Nature of the institution	93%	84%
3. Highest degree offered by the institution	94%	71%

Table 10 shows the average number of communication contacts reported within the department, within the same institution, and with colleagues on a different campus. Again we see that the rate of interpersonal diffusion generally decreases from secondary to tertiary to fourth-level diffusion.

Previously we estimated that at least 10,211 individuals possess awareness-knowledge about one of the four IMPACT innovations.

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*The number of dyads involving different institutions is too small to justify a separate analysis, but an inspection of these data shows a tendency for homophily on the size and nature of institutions.

Table 10. Average Number of Interpersonal Contacts about the Four IMPACT Innovations, by Location of the Individual Talked to by Primary Requestors, Secondary Receivers, and Tertiary Receivers.

Location of Individual Talked To	Average Number of Secondary Receivers Talked to by Primary Requestors (N=3,698)	Average Number of Tertiary Receivers Talked to by Secondary Receivers (N=109)	Average Number of Fourth-level Receivers Talked to by Tertiary Receivers (N=73)
1. Within the same department	$\bar{X} = 0.46$	$\bar{X} = 0.63$	$\bar{X} = 0.26$
2. Outside of the respondent's department, but at the same institution	$\bar{X} = 0.37$	$\bar{X} = 0.68$	$\bar{X} = 0.13$
3. At other institutions	$\bar{X} = 0.09$	$\bar{X} = 0.29$	$\bar{X} = 0.08$
Totals	$\bar{X} = 0.92$	$\bar{X} = 1.60$	$\bar{X} = 0.47$

Table 11 shows the total number of interpersonal contacts per "nominator" for secondary, tertiary, and fourth-level diffusion. Overall, 43 percent (N = 4,411) of interpersonal diffusion is between colleagues in the same department (and hence in the same discipline). Thirty-six percent (N = 3,726) of interpersonal diffusion about the IMPACT innovations is between colleagues who are in different departments in the same institution. Thus, a combined total of 79 percent of interpersonal diffusion is among colleagues within the same institution. The remaining 21 percent (N = 1,421) of interpersonal diffusion is across institutional boundaries (and perhaps across disciplinary lines as well).

The 10,211 "nominators" talked to a total of 9,568 other individuals, an average of 0.94 individuals per "nominator".

Differences and Similarities of 1974 Grantees Versus 1975 Grantees

The 56 applicants who were awarded grants by the Exxon Education Foundation in 1974 were interviewed either by telephone or in person. A 100 percent response was obtained from the 1974 grantees. In January, 1976, we sent a follow-up questionnaire to the 56 1974 grantees in order to determine how many were still using one of the four IMPACT innovations (Data-Set #13).

Table 11. Estimated Total Number of Interpersonal Contacts about the Four IMPACT Innovations, by Location of the Individuals Talked to by Primary Requestors, Secondary Receivers, and Tertiary Receivers.

Location of Individual Talked to	Total No. of Secondary Receivers Talked to by Primary Requestors (N=3,698)	Total Estimated No. of Tertiary Receivers Talked to by Secondary Receivers (N=2,748)	Total Estimated No. of 4th-level Receivers Talked to by Tertiary Receivers (N=3,765)	Total Estimated No. of Individuals Talked to by All Nominators (N=10,211)
1. Within the same department	N=1,701 ($\bar{X}$=0.46)	N=1,731 ($\bar{X}$=0.63)	N=979 ($\bar{X}$=0.26)	N=4,411 ($\bar{X}$=0.43)
2. Outside of the respondent's department, but at the same institution	$\bar{X}$=0.37 N=1,368 ($\bar{X}$=0.37)	$\bar{X}$=0.68 N=1,869 ($\bar{X}$=0.68	$\bar{X}$=0.13 N=489 ($\bar{X}$=0.13)	$\bar{X}$=0.36 N=3,726 ($\bar{X}$=0.36)
3. At other institutions	N=333 ($\bar{X}$=0.09)	N=797 ($\bar{X}$=0.29)	N=301 ($\bar{X}$=0.08)	N=1,431 ($\bar{X}$=0.14)
Totals	N=3,402 ($\bar{X}$=0.92)	N=4,397 ($\bar{X}$=1.60)	N=1,769 ($\bar{X}$=0.47)	N=9,568 ($\bar{X}$=0.94

In 1975, 67 grants were awarded. We sent a mailed questionnaire to the 1975 grantees (Data-Set #12). We personally interviewed 11 percent of the 1975 grantees.

Table 12 shows the differences and similarities for the two sets of grantees. The 1975 grantees are more likely to be teaching faculty (rather than administrators), to be slightly older in age, and less actively involved in interpersonal diffusion about the IMPACT innovations. The two sets of grantees are at medium-sized institutions, where teaching is perceived to be somewhat more important than research and publication in the reward structure.

We generally conclude that the 1974 and 1975 grantees are similar in terms of their institutional characteristics. We think that some of the differences in personal characteristics (mostly in age and the rate of secondary diffusion) may be due to the larger number of Student-to-Student Counseling grantees in 1975 than in 1974.

Of the 38 1975 grantees who responded to our questionnaire, 88 percent (N=33) were using one of the four IMPACT innovations. Two of the grantees had not yet adopted at the time of our survey in January, 1976, while three grantees had discontinued using their IMPACT innovation (because they moved to another institution) or due to student dissatisfaction with the IMPACT innovation.

Table 12. Differences and Similarities of 1974 and 1975 Grantees

Personal and Institutional Characteristics	1974 Grantees ('I=56)*	1975 Grantees (N=67)**
1. Percent who are teaching faculty	60%	74%
2. Age (in years)	37	40
3. Average number of secondary receivers talked to about an IMPACT innovation	$\bar{X}$=2.93	$\bar{X}$=1.41
4. Total student enrollment at the individual's institution	9,316	7,879
5. Weight given to teaching in the perceived reward structure (out of 100 points)	64	57
6. Gourman academic ranking on academic quality of the individual's institution	401	419

* Of whom 35 responded to our January, 1976 follow-up questionnaire.

** Of whom 38 responded to our January, 1976 questionnaire.

Our follow-up study of the 1974 grantees indicated that 31 of the 34 (from whom we could obtain data on discontinuance) were currently using their IMPACT innovation, while four had discontinued by January, 1976.

Clearly, not a very high rate of discontinuance of the IMPACT innovations has occurred among the grantees (only 9 of the 70 grantees from whom we obtained data, or 13 percent).

Ratios of Information Requestors, Proposals, and Adopters

Here we look at the ratios of information requestors, IMPACT grant proposals, grantees, and spontaneous adopters as a means of gauging the breadth of diffusion of the four IMPACT innovations.

Previously we noted that approximately 10,211 individuals possess awareness-knowledge about the four IMPACT innovations. Such awareness may lead to information requests to the inventors about the IMPACT innovations which may be followed by a proposal for an implementation grant to the Exxon Education Foundation, which may result in receiving a grant.

Table 13 shows that by December, 1975 about 7,073 requests had been made about one of the four IMPACT innovations. About 10 percent of the information requestors had made a proposal for

Table 13. The Numbers of Information Requestors to the IMPACT Program,of Grant Proposals Submitted, of Confirmed Spontaneous Adopters, and of Grantees, 1974-76.

The Four IMPACT Innovations	Number of Information Requestors (N=7,073)*	Number of Grant Proposals Submitted (N=734)**	Number of Confirmed Spontaneous Adopters (N=364)***	Number of Grants Awarded by the Exxon Education Foundation (N=123)
1. EXPER SIM	1,765	129	79	25
2. Guided Design	2,105	164	119	33
3. TIPS	1,267	129	28	25
4. Student-to-Student Counseling	1,936	312	138	40
Totals	7,073	734	364	123

* Of the 7,073 requestors in 1974 and 1975, 4,097 (58 percent) requestors received a mailed questionnaire in November, 1974. Of the 4,097 814 (20 percent) had requested information prior to the beginning of the IMPACT program. The remaining 2,976 requestors were added between November, 1974 and December, 1975.

** These 734 proposals were submitted in the first five rounds of grant competition, which includes the period from March, 1974 to February, 1976.

*** Of the 364 spontaneous adopters, 30 adopted an IMPACT innovation prior to November, 1973. The remaining 334 confirmed spontaneous adopters adopted one of the four IMPACT Innovations between 1974 and 1976.

an implementation grant (submitted to the Exxon Education Foundation by February, 1976). Seventeen percent of these proposals resulted in an implementation grant from the Exxon Education Foundation. Of course a majority of the present adopters of the four IMPACT innovations have not received an implementation grant from the Exxon Education Foundation (N=364). These 364 spontaneous adopters may have been influenced to adopt by their colleagues or by grantees, but they did not receive a grant.

We computed a ratio of proposals to information requestors as a percentage of information requestors who made a proposal (Table 14). This percentage is somewhat higher for Guided Design and Student-to-Student Counseling (combined) than for EXPER SIM and TIPS (combined), suggesting that individuals aware of computer-dependent educational innovations are less likely to make a proposal for an implementation grant. However, this difference is mainly due to the 16 percent of Student-to-Student Counseling requestors who made a grant proposal, which is far higher (almost double) than the other three IMPACT innovations.

Table 14. The Ratio of Proposals to Information Requestors, and the Ratio of Adopters to Proposals, by Innovations for the Four IMPACT Innovations, 1974-76.

	EXPER SIM	Guided Design	TIPS	Student-to-Student Counseling	All Four Innovations Combined
1. Number of Information Requestors	1,765	2,105	1,267	1,936	7,073
2. Number of Proposals	129	164	129	312	734
3. Percentage of Information Requestors who made a Grant Proposal	7.3%	8.0%	10.0%	16.0%	10.3%
1. Number of Proposals	129	164	129	312	734
2. Number of Adopters who made a Proposal	32	40	26	58	156*
(a) Grantees	(25)	(33)	(25)	(40)	(123)
(b) Confirmed Spontaneous Adopters (who made a proposal)	(7)	(7)	(1)	(18)	(33)**
3. Percentage of Proposal Makers who Adopted	24.8%	24.2%	20.0%	19.0%	21.2%
(a) Grantees	(19.3%)	(20.0%)	(19.3%)	(13.0%)	(17.2%)
(b) Confirmed Spontaneous Adopters (who made a proposal)	(5.4%)	(4.2%)	(0.7%)	(6.0%)	(4.2%)

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* There are 487 total adopters, including 123 grantees and 364 spontaneous adopters; 156 (32%) of the 487 adopters made a proposal for implementing an IMPACT innovation. Of the 156, 123 (79%) received an Exxon grant and 33 did not receive a grant, but adopted an innovation anyway (and thus are spontaneous adopters).

** The remaining 331 spontaneous adopters (91%) did not make a proposal, but adopted one one of the four innovations; they are: EXPER SIM = 72; Guided Design = 112; TIPS = 27; and Student-to-Student Counseling = 120.

We also computed a ratio of adopters to proposal makers in the form of the percentage of proposal makers who adopted an IMPACT innovation (Table 14), and also separately for grantees and confirmed spontaneous adopters. The overall ratio of adopters to proposal makers is higher for EXPER SIM and Guided Design than for TIPS and Student-to-Student Counseling. The percentages of proposal makers to grantees are lower for Student-to-Student Counseling than for the other three innovations. Spontaneous adopters who submitted an unsuccessful proposal for an implementation grant and adopted the innovation without a grant are lower (than the number of grantees) for all four IMPACT innovations; TIPS proposal makers were especially unlikely to be in this category.

FUTURE ADOPTION AND DISCONTINUANCE

Our research question #2 is: What future adoption, and perhaps discontinuance, will occur among the individuals who are presently requestors, grantees, and spontaneous adopters?

Here we look indirectly at the consequences* of the four IMPACT innovations. One measure of whether the consequences of the four IMPACT innovations were perceived as favorable or not is the number (and rate) of discontinuances that occurred. Discontinuance is the decision to cease use of an innovation after previously using it.

Previously, in Figure 3, we showed that about 10 percent of the 10,211 individuals who learned about one of the four IMPACT innovations as information requestors, secondary receivers, or as tertiary receivers have adopted.** The rate of adoption is highest for secondary receivers (14 percent), lower for tertiary receivers (10 percent), and lowest for information requestors (7 percent).***

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* Consequences are changes that occur within a social system as a result of the adoption or rejection of an innovation.

** These are "unconfirmed" adopters, of which 487 were "confirmed" by various checks and cross-checks we were able to make between our various data-sets.

*** These rates of adoption are not exactly comparable because the information requestors, secondary receivers, and tertiary receivers had possessed awareness-knowledge of the IMPACT innovations for differing lengths of time (at the time of the data-gathering).

Table 15 shows there are to date 487 "confirmed" adopters of the four IMPACT innovations: (1) 123 adopters were awarded an Exxon Education Foundation implementation grant between 1974-75, and (2) 364 individuals are spontaneous adopters and adopted one of the IMPACT innovations with a grant.

To date we have learned about only 26 discontinuees among the 487 confirmed adopters (an overall rate of 5 percent). Nine grantees (7 percent of the 123) and 17 spontaneous adopters (5 percent of the 364) discontinued using an IMPACT innovation during 1975-76.

Sources of Data on Discontinuance

We kept in touch with the 56 grantees who received grants in 1974 by means of a mailed questionnaire follow-up to determine (1) how many of the grantees are still using the innovations, (2) what kinds of modifications they have made, if any, and (3) what their overall experience has been with the innovation since adoption. Of the 38 grantees from whom we gathered data, six discontinued using an IMPACT innovation by 1975.

We also sent a questionnaire to all the grantees (N=67) who received grants in 1975. We received 38 questionnaires (57 percent). Of these 38, three stopped using an IMPACT innovation by March, 1976.

Table 15. Type of Adopters of the Four IMPACT Innovations, by Innovation and by Year of Adoption (as of May, 1976).

	Grantees					Spontaneous Adopters					
Year of Adoption	EXPER SIM (N=25)	Guided Design (N=33)	TIPS (N=25)	Student-to-Student Counseling (N=40)	Total (N=123)	EXPER SIM (N=79)	Guided Design (N=119)	TIPS (N=28)	Student-to-Student Counseling (N=138)	Total (N=364)	Four Innovations Combined (N=487)
1974	52% (N=13)	56% (N=14)	48% (N=12)	43% (N=17)	46% (N=56)	46% (N=36)	52% (N=67)	41% (N=11)	75% (N=105)	60% (N=219)*	56% (N=275)
1975	48% (N=12)	44% (N=19)	52% (N=13)	57% (N=23)	54% (N=67)	33% (N=26)	34% (N=41)	33% (N=9)	16% (N=22)	27% (N=98)	34% (N=165)
1976**	0	0	0	0	0	21% (N=17)	10% (N=11)	26% (N=8)	9% (N=11)	13% (N=47)	10% (N=47)
Totals	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

* Thirty persons (14 percent of these 219) actually adopted one of the four IMPACT innovations prior to November, 1973, when the IMPACT program was launched.

**Data on the number of grantees in 1976 was not available at the time of the present analysis, and of course the number of 1976 spontaneous adopters was incomplete at the time of our last data-gathering in May, 1976.

By May, 1976, there were 364 spontaneous adopters of the four IMPACT Innovations. There were 208 spontaneous adopters in the first year of our study from 1974-1975. Of these, we learned of nine who discontinued using their innovation by August, 1975. Another source of spontaneous adopters are inventors, grantees, and other spontaneous adopters who mentioned individuals who may have adopted the innovation. We followed up these leads. We sent letters to suspected adopters, and conducted telephone interviews with secondary and tertiary receivers nominated by information requestors between October, 1975 and May, 1976. We added 112 new adopters to our list of confirmed spontaneous adopters in this way. Of the 112, five adopters had discontinued using an IMPACT innovation.

"Intend-to-adopt" are those individuals who indicated in the 1974-75 mailed questionnaire that they intended to adopt the innovation in the next academic year. We sent 199 questionnaires to such individuals in December, 1975. We received a response rate of 60 percent (120 responses). Forty-four persons had adopted an IMPACT innovation; of the 43 adopters, three had used an IMPACT innovation and decided not to continue using it by November, 1975.

In summary, we obtained the names of discontinuances of the four IMPACT Innovations by:

1. Asking the four inventors and one sub-inventor about possible discontinuances by grantees and spontaneous adopters.
2. Our telephone and letter contact with certain adopters.
3. The questionnaire study of the 199 intend-to-adopt individuals in December, 1975.
4. Our follow-up questionnaire to 56 1974 grantees, to 67 1975 grantees, and 364 spontaneous adopters who received a mailed questionnaire and/or were interviewed between 1974-1976.

From these sources, we estimate the following number and rate of discontinuances.

	Number of Discontinuances	Rate of Discontinuance for Confirmed Adopters
1. EXPER SIM	7	7%
2. Guided Design	12	8%
3. TIPS	3	6%
4. Student-to-Student Counseling	4	2%
Total	26	5%

Interviews with Adopters who Discontinued

We interviewd many of the adopters of the four innovations between 1974-1976. During those interviews we determined reasons for discontinuance.

Of the 26 discontinuances, two moved to an administrative post, and six to another university. A "financial crunch" at the individual's institution led to discontinuance in five cases. Exact causes of the other 13 discontinuances could not be determined.

Here are two brief case descriptions of discontinuances.

Professor "K" was dissatisfied with the results of Guided Design, and so adopted EXPER SIM as an alternative teaching approach. Dr. "K" attended a workshop conducted by the inventor of Guided Design in early 1973, where he learned about the innovation, and adopted it in his freshman engineering courses in Fall, 1973. After a year's experience with the innovation, Dr. "K" concluded that it was not compatible with his personal philosophy of teaching, and so he dropped it, and decided to adopt EXPER SIM in 1975.

Professor "C" was a satisfied adopter of Guided Design from 1970 to 1974. However, in 1974 she was appointed to Assistant Dean of her college, and thereafter found that she had inadequate time available to prepare the Guided Design materials for her course. So she was forced to discontinue use of the innovation.

Another type of data bearing on discontinuance is reviewed under Research Question #3 on modification, expansion, and re-invention. We found very little re-invention, one indirect evidence of the generally favorably perceived consequences of the four IMPACT innovations by their adopters.

Reasons for Adoption

Of the 487 confirmed adopters of the four IMPACT innovations, 461 (95 percent) are satisfied users, who have not discontinued.* These individuals provided many types of personal experience about the favorable consequences of the innovations during our interviews. One important consequence of the IMPACT innovations is that they frequently change the role of teachers and counselors. The philosophy of teaching/counseling that the innovations promote have frequently changed the behavior of the adopters; for example, one adopter stated, "Guided Design requires the teacher to get out of the lecture-giving role and force oneself to truly guide students' learning." Many adopters perceived the use of an IMPACT innovation as an "organizing" influence on their teaching style, providing them with a greater degree of preparation for their classes. For example, one respondent said: "In literature, there is very little appreciation for precision. I found TIPS to be an excellent self-disciplinary experience. It has a great potential for social change as it allows for a healthy heterogeneity and at the same time maintains legitimate differences both among students and teachers."

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* Although it must be kept in mind that many of the 461 "satisfied" confirmed adopters of the IMPACT innovations have only adopted for a year or two, and hence may have a somewhat limited opportunity for discontinuance.

EXPER SIM adopters mentioned the following advantages of the innovation:

1. It provides students with an opportunity to be creative and independent.
2. EXPER SIM provides an appreciation for the use of computers.
3. It makes students aware of the time and cost involved in conducting research.
4. It extends the range of learning activities for students in a research design course.
5. EXPER SIM develops the ability to formulate research strategies.

Guided Design adopters mentioned the following advantages:

1. It develops self-assurance and self-expression on the part of students.
2. It reduces the transition in styles of thinking required in going from college to the first job.

3. Guided Design develops independent and original thinking.
4. It introduces students to a sequential method of thinking.
5. It develops sensitivity and appreciation for value systems.
6. It increases students' analytical skills
7. Guided Design helps them actively seek solutions rather than be just a passive learner.

TIPS adopters gave these main advantages:

1. It helps diagnose problem-students early in the term.
2. TIPS allows teachers to better manage information and thus focus attention on the subject-content.
3. It forces students (as well as teachers) to be more familiar with the subject matter.
4. TIPS individualizes instruction in a large class.
5. It develops better study habits.

The adopters of Student-to-Student Counseling mentioned the following advantages:

1. It fosters a type of relationship between the student counselor and the counselee that professional counselors cannot have.

2. It fosters more empathetic counseling services.
3. It helps freshmen in the transition from high school to college life.
4. It helps reduce the student attrition rate, especially among freshmen.
5. It gives student counselors a useful work experience and helps them prepare for a professional role.

Future Adoption of the Four IMPACT Innovations

Here we look at the most likely individuals where we suspect that adoption will take place. We look at the possible categories of future adopters: (1) proposal makers who did not receive an implementation grant, (2) intend-to-adopters who did not respond to our follow-up questionnaire in 1975, and (3) present non-adopters who have awareness-knowledge about an IMPACT innovation.

We previously noted there are 734 individuals who submitted a grant proposal to the Exxon Education Foundation by February, 1975. Only 123 of the 734 received a grant in 1974 and 1975. Thirty-three (5 percent) adopted an innovation without receiving an implementation grant. We expect that 578 individuals who have gone beyond the stage of only being an information requestor, to a more advanced stage of interest in the innovation (as indicated by submitting a grant proposal) are more likely to adopt that innovation in the future. We think that more of the 578 individuals whose grant application was unsuccessful (but who have not adopted) will adopt in the near future. Table 16 shows these 578 individuals as possible future adopters of the four IMPACT innovations.

A number of respondents have definite plans to adopt an IMPACT innovation, but were not using an innovation at the time we gathered data from them. As we noted previously, there were 199 such "intend-to-adopt" respondents in our 1974-1975 questionnaire study of information requestors. We followed up these 199 "intend-to-adopt" in December 1975, by mailed questionnaire (Table 1). We received a 60 percent response rate. Among the 120 who returned the questionnaire, 44 (37 percent) were "new" adopters. So we estimate that about 74 of the 199 intend-to-adopters eventually will adopt by late 1976.

Further, we estimated previously that there are 471 who "intend-to-adopt" among the 10,211 estimated knowers of the four IMPACT innovations. Out of the 471 intend-to-adopters, an estimated 174 individuals may have adopted (using the estimated 37 percent rate of adoption obtained for the information requests above).

Table 16. Estimated Possible Future Adopters of the Four IMPACT Innovations.*

	Individuals Who Have Adopted an IMPACT Innovation	Individuals Who May Adopt an IMPACT Innovation in the Future	Total Number of Possible Adopters of IMPACT Innovation (both actual and potential)
1. Individuals Who Submitted a Proposal from 1974 to February, 1976	156 ("confirmed adopters)**	578	734
2. Individuals Who Intend-to-Adopt an IMPACT Innovation	174 (estimated adopters)	297	471
3. Individuals Who Have Awareness-Knowledge about an IMPACT Innovation	1,025 (estimated adopters)	9,186	10,211

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[*] No totals are shown for the columns in this table, as the three rows are not mutually exclusive.

[**] Of the 156, 123 received an implementation grant by December, 1975, and 33 individuals submitted a proposal but did not receive an implementation grant from the Exxon Education Foundation, and thus are spontaneous adopters.

The third group of individuals who may be future adopters are 9,186 individuals who, by our estimates, have awareness-knowledge about the IMPACT innovations but have not yet adopted. For this category, we have previously discussed the results of our surveys of information requestors, secondary receivers, and tertiary receivers; we estimated the overall adoption rate to be 7 percent, 14 percent, and 10 percent, respectively* (Figure 3). Table 16 shows there are an estimated 1,025 adopters (10 percent) among the 10,211 individuals with awareness-knowledge, leaving 9,186 possible adopters at some future time.

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* A further survey with the estimated 1,355 fourth-level receivers could provide further data on future adoptions.

IMPLEMENTATION

Our research question #3 is: What is the process of implementation for the IMPACT innovations?

We consider the process of implementation as one of the two sub-processes in the innovation process (Figure 4). In the present study, we investigated such aspects of implementation as the type of adopters, evaluation of the effectiveness of the four IMPACT innovations, and re-invention and modification of the four IMPACT innovations.

Implementation

Implementation is the sub-process in the innovation process that begins with the decision to adopt an innovation, and continues through the steps involved in using the innovation, until the innovation is institutionalized to the point at which the idea loses its newness and has become an unrecognizable element in the adopting unit's ongoing operations (Agarwala-Rogers and Rogers, 1976). The initiation sub-process begins with recognition of a felt need or problem and continues until decision to adopt or reject.

Most past research on the diffusion of innovations deals with the characteristics or variables associated with innovativeness (that is, being relatively early or late in adopting new ideas). Thus, we know a great deal about the nature of innovative schools, teachers, farmers, etc.

I. INITIATION

1. Felt need (or perceived problem)
2. Knowledge of the innovation
3. Decision to adopt or reject

II. IMPLEMENTATION

1. Planning for adoption
2. Learning to use the innovation
3. Adapting the innovation to local conditions
4. Beginning actual use, or installation, of the innovation
5. Evaluation (1) of the degree to which an innovation meets a felt need, and (2) of its other consequences
6. Decision to continue using, or to discontinue, the innovation
7. Institutionalization of the innovation into the ongoing activities of the adopter, so that its separate identity gradually disappears.

Figure 4. The Innovation Process Consists of the Sub-Processes of Initiation and Implementation

But very little research has dealt with the process of innovation, the decision-making sequence over time through which a new idea is put into use.

Further, most past research on innovation stops with the decision to adopt (that is, with initiation), and ignores implementation (Fullan and Pomfret, 1975). Studies of the usual dependent variable of innovativeness tell us little about how an innovation is actually put into use, and to what consequences. A recent exception is a case study of implementation of an innovation in a school by Gross and others (1971).

So the present research is distinctive from most past work in its focus on implementation. It also differs from most past diffusion researches which look "backward" at the process after it has occurred (through the eyes of the adopter-respondents); our research seeks to study diffusion while it is underway.

Those individuals who decided to adopt an IMPACT innovation during the initiation stage have either submitted a proposal or they have not. We noted in our Research Question #1 that in addition to the 123 grantees, 33 individuals who submitted a proposal to the Exxon Education Foundation have adopted one of the four innovations even though they did not receive an IMPACT implementation grant. These 33 individuals constitute approximately 9 percent of the total number of spontaneous adopters who have made plans to adopt and have gone beyond the stages of awareness-knowledge. The 33 made plans to adopt and have allocated other resources for the adoption of an IMPACT innovation. Commitment of funds through departments or other sources than the Foundation were important in adoption for 364 spontaneous adopters (who adopted an IMPACT innovation).

All the 123 grantees attended a workshop conducted by the four inventors on their campuses. The overall conduct of the workshops by the four inventors was perceived to be very satisfactory by the participants that we interviewed. We participated in the 1974 workshops, and were favorably impressed. Learning to use one of the four innovations at the workshops meant that the attendees usually came with a plan for use of their innovation based on their proposal, and many had prepared some instructional materials prior to coming to the workshop. In a simulated situation, they used the materials in the two days at the workshop. For the two computer-related innovations, participants actually used computers during the workshop. Thus, the actual use of the IMPACT innovations at the workshops was one of the most important aspects of "learning to use" the innovations.

During and after the workshops, some grantees kept in touch with the inventor as they encountered difficulties in the installation of their innovation. In the case of TIPS, computer assistance from the inventor and his staff were provided so that the TIPS program was actually running at the grantee's institutions when he decided to adopt. Once an IMPACT innovation is adopted, adaptation of the idea to local needs begins, as many of the adopters are in disciplines different from those of the inventors. Thus, new subject materials must be designed and the innovations must be adapted to local conditions of use. Later in this section we discuss motivation for "re-invention" and modification of the four IMPACT innovations.

Evaluation Studies of the IMPACT Innovations

Evaluation of the consequences of the IMPACT innovations is conducted by inventors, grantees, and spontaneous adopters. We have located 35 evaluation reports, a majority of which were written by grantees or inventors. Later in this report we summarize the main findings from the evaluations of the four IMPACT innovations.

We sent letters in August, 1975 to the known adopters of the four IMPACT innovations. Only 12 of the 142 adopters responded that they were doing an evaluation of their use of the IMPACT innovation and sent us their reports. In January, 1976, we resurveyed the 56 1974 grantees of the four IMPACT innovations. As part of this questionnaire, we asked all grantees about their subjective experiences and evaluations, if any, of the four IMPACT innovations. Some persons offered subjective comments, and 15 had completed evaluations. By May, 1976, we located 35 evaluation studies, some of which were published by inventors and spontaneous adopters, and some of which were final reports to the Exxon Education Foundation by grantees in 1974 and 1975.

Evaluation is a type of research that is conducted to determine the effects of programs or projects, under operational conditions, in order to provide a scientific basis for decisions (Rogers and Agarwala-Rogers, 1976b). Field experimental designs are frequently utilized to evaluate the consequences of the IMPACT innovations. A field experiment is an active intervention by an experimenter who administers a treatment to randomly selected respondents arranged in groups that are equivalent in the way they were chosen, with at least one treatment and one control group (that does not receive any treatment).

The four inventors have gathered fairly detailed evaluative data about the effectiveness of their innovation. Dana Main, Charles C. Wales, Allen C. Kelley, and William F. Brown have each published in various professional journals about their experiences with the use of their innovation, as have sub-inventors Arthur Cromer and Bassam Shakhashiri. The adopters of EXPER SIM (who use this innovation to teach research and experimental methods) have been less interested in conducting field experiments on the innovation's consequences.

Typical of the evaluation studies is the investigation by Main and Nussloch (1975), who compared the effectiveness of another pedagogical strategy in teaching introductory experimental psychology (having students read, analyze, and critique journal articles) with having students design and run mock experiments with computer data generated to test hypotheses (the basic EXPER SIM approach). The second approach was found to be more effective as a method of teaching. Cromer and Thurmond (undated) have substantiated these findings.

Charles Wales has made several attempts to evaluate Guided Design in comparison with the usual lecture-based approach to teaching large classes. Wales found that the Guided Design approach generally is superior in teaching knowledge, sensitivity to value systems, and decision-making ability, whereas the traditional method of lecture teaching focuses mainly on the "passing on" of knowledge. Evaluation studies by Wales and his colleagues (1973, 1975) report an increase in the overall grade-point of engineering students taught with the Guided Design approach.

Findings from various evaluation studies conducted at West Virginia University, Wayne State University, Youngstown State University, Wichita State University, and the University of Michigan, on the various facets of the effectiveness of Guided Design show that:

1. It increases students' tolerance for ambiguity.
2. It increases students' need for achievement.
3. It lowers students' anxiety.
4. It improves students' performance in professional schools.
5. It makes them more effective in communication skills.
6. It helps systematic development of such intellectual activities as knowledge, comprehension, application, analysis, synthesis and evaluation.

Perhaps TIPS (more than any of the other IMPACT innovations) has been studied with a greater degree of scientific rigor. A study involving about 1,000 students in economics classes indicated that the use of TIPS: (1) increased student achievement, (2) increased relatively poorer students' achievement more than it increased the performance of better students, (3) led to improvement in student performance independently of the type of examination questions used, and (4) was not limited by student hostility toward computers. The choice of major two years after the course shows that a number of the students chose economics. Some data on the cost-effectiveness of TIPS was also provided by Kelley's (1968, 1970) studies.

Dr. Bassam Shakhashiri of the University of Wisconsin-Madison reported that TIPS is a more effective method of teaching chemistry and that students generally like it. In one field experiment, the same professor taught two classes, one using "ChemTIPS" and the other without it. ChemTIPS had greater effectiveness.

Dr. William Brown (1972) and his associates have conducted more than 30 investigations of the effectiveness of Student-to-Student Counseling involving approximately 42,500 students enrolled at 60 high schools and colleges. These evaluation studies show that the students counseled by other students receive higher academic grades and are less likely to drop out of college than students not counseled by student counselors. In comparison to professional counseling, Student-to-Student Counseling is generally much more cost-effective.

Some of the measures of effectiveness that were utilized in the 35 evaluation studies are:

1. Student grade point changes
2. Student motivation
3. Student attitudes toward computers, to peer counselors, and to other aspects of the IMPACT innovations
4. Student attrition rates (especially for peer counseling)
5. Decision-making ability in the face of many issues (especially for Guided Design).
6. The ability to design research and to interpret data (especially for EXPER SIM)

7. Student ability to develop an organized and efficient way of learning (for TIPS)
8. Student retention of subject matter
9. Student choice of major as a result of the use of the innovation
10. Cost per student taught or counseled.

A study dealing with computer-assisted learning projects at various universities indicates that: "The computer's unique ability to provide low-cost enrichment represents the most under-exploited aspect of educational technology. It follows that the real impact of the new technology will be for the most part adding to, rather than replacing, current learning mechanisms" (Rockart and Morton, 1975). This comment applies directly to the two computer-dependent IMPACT innovations of EXPER SIM and TIPS, and also to Guided Design and Student-to-Student Counseling in the sense that they also represent increments rather than substitutions for "traditional" teaching and counseling procedures. So an appropriate research design for evaluation of the innovations' effectiveness usually involves a comparison of the use of the IMPACT innovation with a traditional procedure. These studies usually follow some type of field experimental design.

Not all of the field experiments on the effectiveness of the four IMPACT innovations represent ideal research designs. For example, some designs do not include a control group or some other comparison in order to provide a basis for measuring the relative effectiveness of the innovation. Precise data on the cost-effectiveness of the innovation are not always gathered. Nevertheless, we feel the overall results of these field experiments are generally convincing. We conclude that the consequences of the four IMPACT innovations (1) are generally perceived by adopters and students as favorable, and (2) are usually evaluated as advantageous when compared to traditional approaches to teaching/counseling in field experiments.

Re-Invention*

The common expression "re-inventing the wheel" suggests the apparent ubiquity with which a new idea is separately re-created in an adopting unit. The context in which the phrase is used implies that re-invention occurs fairly often in a spontaneous and unplanned fashion, and that re-invention represents an unintended waste of resources through a duplication of creative activities: That innovation would be more efficient than re-invention.

Re-invention is the degree to which an innovation is changed in the process of implementation, after its original development as a new idea (Agarwala-Rogers, 1977). The basic conception of the four innovations is kept essentially intact, in the case of many adopters, but after they renamed the innovation, the computer program was modified, new teaching models were created, the innovation was utilized in a special way in a course, or the counselors were trained differently. So a great deal of adopter-to-adopter variation in the innovation was encountered.

Why does re-invention occur? Some adopters may have a kind of "prima donna" complex in insisting that the innovation is their own invention, an attitude perhaps motivated by local pride in that giving an innovation such a name gives it local identity (Havelock, 1973). Many times, however, differing local conditions necessitated some modification of the IMPACT innovations to suit local needs.

Past research on the diffusion of innovations has generally not recognized the possibility of re-invention. Thus research on innovation in organizations, for example, has assumed that a new technological idea enters the system from external sources, and then is adopted (with relatively little change or adaptation in the innovation) and implemented as a part of the organization's ongoing operations.

In actuality, many innovations may go through extensive revision in the process of their adoption and implementation, and may almost be re-invented by the organization. For example, Charters and Pelligrin (1973) found in public schools that the innovation of "differentiated staffing" (an idea meant to encourage the hiring of both a variety of teachers and para-professional teaching aides, and assigning them to classroom tasks on the basis of their skills and interests) was little more than a vague word to most school staff. The innovation meant widely different staffing policies and assignments to most individuals, and its substantive meaning was actually assigned by local school officials and teachers only as the idea was actually being implemented. "The innovation was to be invented on the inside, not imported from the outside" (Charters and Pelligrin, 1973).

So adopters may often adopt not a specific blueprint for an innovation, but a general and abstract conception whose operational meaning gradually unfolds in the process of adopting and implementing the new idea. Naturally, there are various degrees of re-invention, ranging from none in some cases, to slight modification, to major overhaul of the innovation.

We tried to determine the degree to which modification/re-invention of the four IMPACT innovations occur by (1) telephone interviews with adopters in March, 1975, (2) our mailed survey with 199 intend-to-adopt individuals in December, 1975, and (3) our interviews with secondary and tertiary receivers.

We identified 32 adopters with at least some degree of modification/re-invention:

		Number of Adopters
1.	EXPER SIM	2
2.	Guided Design	6
3.	TIPS	5
4.	Student-to-Student Counseling	19
	Total	32

In one sense, this figure suggests that a rather modest degree of re-invention occurred in the case of the four IMPACT innovations. But we only recognized the possibility of modification/re-invention during the first year of the present study, and our methods of data-gathering are far from perfect for measuring the degree of re-invention with much precision. So we are undoubtedly underestimating the amount of re-invention among adopters of the IMPACT innovations.*

Our findings do indicate that diversity occurs in the application of the four IMPACT innovations. They are imported into various institutions, sometimes as a general concept (Guided Design) and others as computer programs (EXPER SIM and TIPS). These innovations may go through a process much like re-invention as the innovation is applied to meet the institution's characteristics, such as size of class, nature of the student body, make and model of the computer used, subject matter and so on.

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*In fact some degree of re-invention probably occurs in every case of adoption, although it may be difficult to measure precisely (and past research has not been alert to the possibility that such re-invention could be occurring).

One of the operational problems in studying re-invention is how to measure it. We asked the inventors to provide us with a list of operational elements essential to the adoption of their innovation. For example, Professor William F. Brown identified the following essential elements for the adoption of Student-to-Student Counseling:

1. Utilization of a systematic selection procedure to assure that student counselors possess requisite core skills.
2. Utilization of a systematic training program to assure that student counselors develop requisite job specific skills.
3. Utilization of standardized test data to facilitate identification and correction of academic adjustment problems.
4. Utilization of stated counseling goals to guide the formulation of counseling methods and the selection of guidance materials.
5. Utilization of standardized test-retest data to facilitate evaluation of program effectiveness.

Similarly, Professor Charles Wales identified the following four elements in Guided Design which he feels are essential:

1. Small group discussion in class; the teacher manages the class and consults with the groups but they work independently.
2. Decision-making work, which is done in class and is guided by printed instruction-feedback pages. These pages present simulated, but realistic, problems which model the decision-making work of a professional or group.
3. Subject matter is generally studied outside of class when it is relevant to a project step. Some of what is studied is needed to make a better decision.
4. The decision-making work usually results in a written and/or oral report. Subject-matter tests are given in the usual way.

Elements such as these for each innovation can provide a guideline for measuring the degree of modification/re-invention in each adoption. For example, if an adopter of Guided Design is using all four of the elements above, he has made little real modification in Professor Wales' conception of the innovation. Unfortunately, we were not able to utilize this approach to measuring modification/re-invention, but are now ready to do so in future research.

We observed that the nature of the innovation, as well as the policy of the inventor, are factors determining the degree to which re-invention of an innovation may occur. Figure 5 shows the approximate position of the four innovations on a continuum of generality/specificity. The general nature of Student-to-Student Counseling affects the degree of re-invention that occurs. The innovation is flexible and abstract in definition, and so it is rather difficult to say exactly where Student-to-Student Counseling à la Brown begins and stops. But with the key elements now identified by Professor Brown, this measurement is now possible.

Guided Design is more specific, as Dr. Wales has detailed outlines of its operational procedures, philosophy, and objectives. EXPER SIM and TIPS are the most specific of the four IMPACT innovations, in part due to their computer-dependence. Hence they may be more likely to be re-invented, or at least such changes are more likely to have been measured by us in our present investigation. This line of thinking leads us to hypothesize that technological innovations may be more likely to be re-invented than are non-technological innovations, or at least such re-invention is more likely to be measurable.

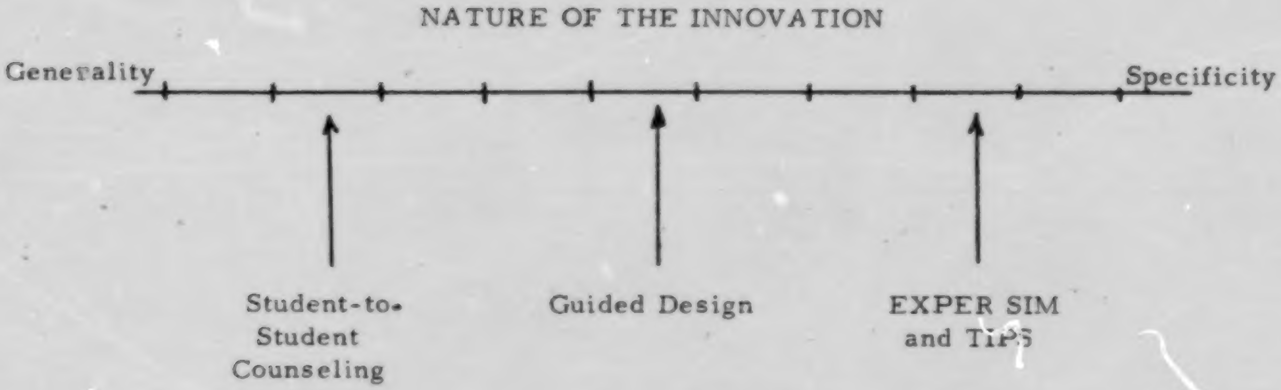
NATURE OF THE INNOVATION
Generality
Specificity
Student-to-Student Counseling
Guided Design
EXPER SIM and TIPS

Figure 5. Approximate Location of the Four IMPACT Innovations on a Continuum of Generality/Specificity of the Innovation.

Our respondents mentioned the following adaptations, modifications, and re-inventions they had made in the four IMPACT innovations.

I. EXPER SIM

1. Generated new models (did not use the MESS or LESS versions).
2. Addition of a different model of educational technology.
3. Added several features (unspecified) to the LESS version.

II. GUIDED DESIGN

1. Integrated Guided Design with a teaching team approach.
2. Time pacing of the instruction/feedback loop.
3. Use of less-structured instruction/feedback sheets.
4. Less reliance on programmed material.

III. TIPS

1. More elaborate explanations of answers incorporated into the TIPS program.
2. Incorporated pretest data into the decision rules.

IV. STUDENT-TO-STUDENT COUNSELING

1. De-emphasis of the study skills aspect in using the innovation for college social adjustment problems.
2. Updating of materials to reflect more contemporary speech problems.
3. Used in a program for disadvantaged students, and used in a freshman orientation course.

The present investigation over the last two years shows us that an innovation is not always implemented in the manner exactly envisioned by the inventor. How many different variations of the innovations are there? Perhaps some innovations are best re-invented, adapted rather than adopted.

FURTHER IMPACT INNOVATIONS

Research question #4 is: What is the comparative nature of the diffusion of further IMPACT innovations that are selected?

Of the six research questions guiding our 1975-76 investigation, we were able to do the least adequate job of answering this question on the comparative nature of the diffusion of other IMPACT innovations. A fifth and sixth IMPACT innovation were announced about midway through the 1975-76 year: (1) CVIS (for "Computerized Vocational Information System"), a package of computer software that provides a series of career-guidance experiences for direct use by the student along with certain administrative-counselor support functions, and (2) the Dartmouth Intensive Language Model, which is centered on the use of qualified undergraduate "assistant teachers" who help the master teacher.

CVIS was developed by Dr. Jo Ann Harris Bowlsbey in 1967-70 at Willowbrook High School in Villa Park, Illinois. The language teaching innovation was created by Professor John A. Rassius at Dartmouth College, Hanover, New Hampshire. We were able to obtain detailed information about these two IMPACT innovations by visiting adopters, and from printed materials. In addition, the IMPACT program has produced a 25-minute color film about the Dartmouth Intensive Language model.

Unfortunately, we were unable to gather data about the diffusion and adoption of these two newer IMPACT innovations during 1976. So comparison of those two innovations with the original four IMPACT ideas remains only a promising research lead. This is a research opportunity to gain further understandings about the rate of diffusion of IMPACT innovations on the basis of (1) their use in counseling versus teaching, and (2) their computer dependence. The two newer IMPACT innovations offer a neat contrast on these two dimensions with the original four innovations:

	Teaching	Counseling
Computer-dependent	1. EXPER SIM 2. TIPS	1. (CVIS)
Not computer-dependent	1. Guided Design 2. (Dartmouth Intensive Language Model)	1. Student-to-Student Counseling

LOCAL DIFFUSION NETWORKS

Research question #5 is: What is the nature of local networks that seem to affect the diffusion of the IMPACT innovations?

A network consists of interconnected individuals who are linked by patterned communication flows. We studied three networks through which one of the four IMPACT innovations diffused interpersonally. The following criteria guided our choice.

1. The network includes at least two adopters.
2. Active dissemination has occurred, as shown by the branching of message-transmission to a wider number of individuals from the initiators. In other words, "networking" is occurring.
3. One of the networks is centered on a single university campus, one is a statewide computer network, and one is a community college network. Hence, we include both more local and less local networks.
4. A different IMPACT innovation is involved in each of the networks selected for study.

Interpersonal Networks at West Virginia University

The West Virginia University (WVU) is divided into three subcampuses: (1) the Evansdale Campus, which houses engineering, creative arts, education, counseling and guidance, and other professional schools; (2) the Medical Campus, with medical, health, and nursing located on its premise; and (3) the Downtown Campus, which houses most of the social sciences and physical sciences.

WVU is a state university offering programs in liberal arts, teacher preparation, and other professional fields. The highest degree offered is the doctorate. There are 1,100 faculty members at WVU, and approximately 17,000 full-time students. West Virginia University is located in Morgantown, West Virginia, where Professor Wales, the inventor of Guided Design, is Director of Freshman Engineering. The Guided Design innovation, spearheaded by Professor Wales, has spread at WVU to such fields as philosophy, music, physics, nursing, and geology.

At West Virginia University, we identified approximately 115 faculty members in 26 disciplines with awareness-knowledge about Guided Design; 49 percent of them mentioned that they either contacted Professor Wales or heard him speak about Guided Design. Thus about 10 percent of the total faculty at WVU are exposed to Guided Design.

We sent mailed questionnaires to 100 primary and secondary receivers of Guided Design in January-April, 1976. In addition, we personally interviewed 20 of the 100 known primary and secondary receivers between October, 1974 and December, 1975. We received a combined response rate from the questionnaire and personal interviewing of 80 percent from the 100 individuals.

The network data were gathered in three steps based on the time of data-collection: Primary, secondary, and tertiary. We first reached the primary receivers who either requested information about Guided Design from Professor Wales or heard about it from him.

These primary receivers, in turn mentioned secondary receivers with whom they talked about Guided Design. These secondary receivers then mentioned tertiary receivers with whom they discussed Guided Design. We collected data from the primary and secondary receivers, but due to time limitations, we could not reach the 15 known tertiary receivers at West Virginia University (Figure 4).

Two activities that facilitated the adoption of Guided Design at West Virginia are (1) the Nature of Evidence course, a multidisciplinary course, and (2) the Lilly Endowment Program for intern-mentor teaching.

The Nature of Evidence course was developed by Professors Wales and Gene D'Amour for freshman-sophomore level students with two objectives: (1) to help the student determine what constitutes adequate evidence, and (2) to explore the various evidential techniques and skills that are used by professionals in the natural and social sciences and humanities. Guided Design was used in the course as the mode of instruction-learning. Twelve faculty members from as many different fields initially wrote the Guided Design projects. An experimental Tanzanian village named "Rwamkoma" was the center of the students' learning activities. Each project presented a village-related problem which necessitated that students acquire certain information to which they would apply some evidential technique of a particular discipline. This course had an enrollment of 35 students when it was originally taught in 1974; the students were divided into small groups with one undergraduate teaching assistant, who earned

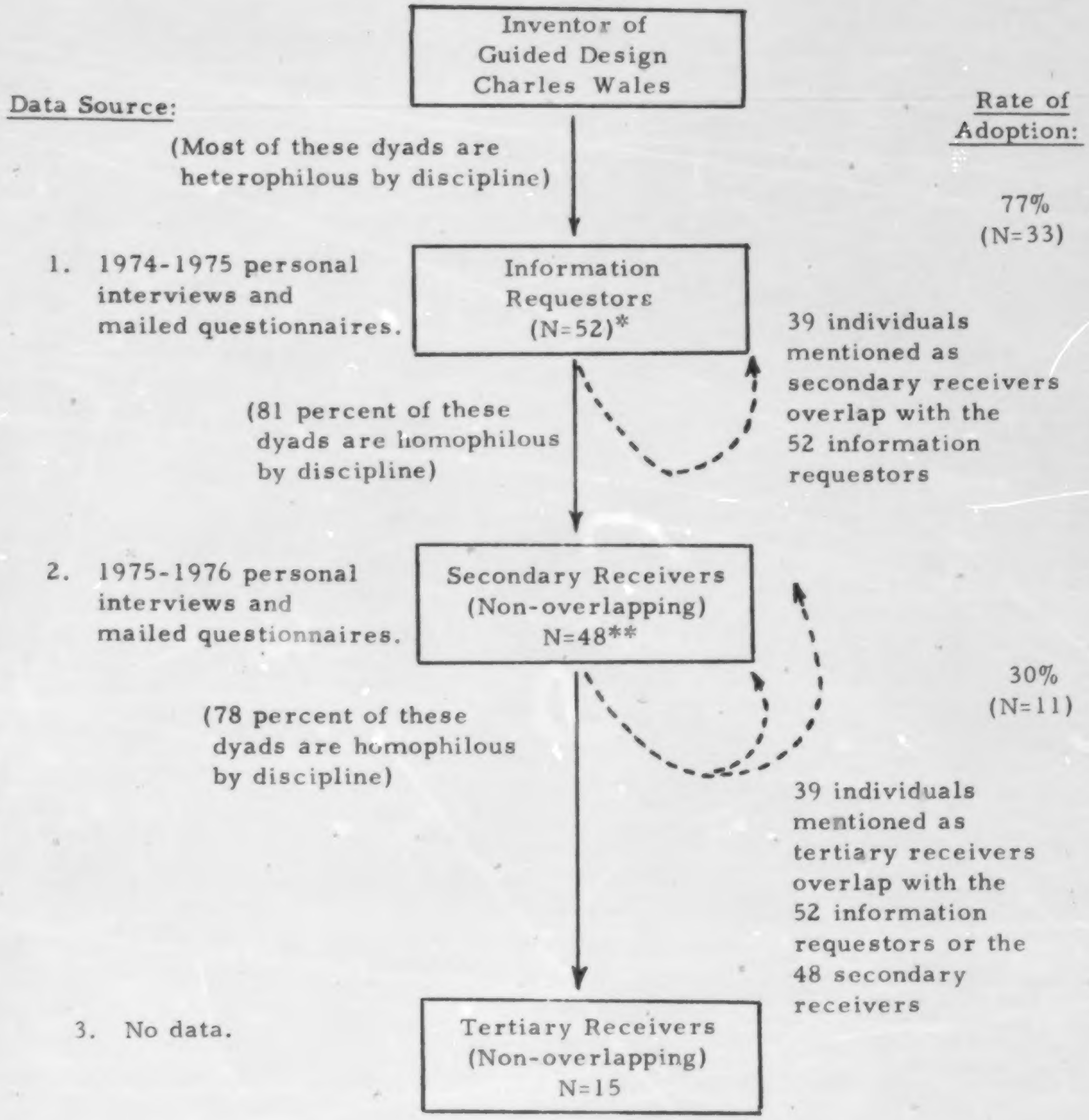
Inventor of Guided Design Charles Wales
Data Source:
Rate of Adoption:
(Most of these dyads are heterophilous by discipline)
77% (N=33)
1. 1974-1975 personal interviews and mailed questionnaires.
Information Requestors (N=52)*
39 individuals mentioned as secondary receivers overlap with the 52 information requestors
(81 percent of these dyads are homophilous by discipline)
2. 1975-1976 personal interviews and mailed questionnaires.
Secondary Receivers (Non-overlapping) N=48**
30% (N=11)
(78 percent of these dyads are homophilous by discipline)
39 individuals mentioned as tertiary receivers overlap with the 52 information requestors or the 48 secondary receivers
3. No data.
Tertiary Receivers (Non-overlapping) N=15

Figure 4. Secondary and Tertiary Diffusion of Guided Design at West Virginia University.

* Only 43 of these 52 information requestors (83 percent) responded.

** Only 37 of these 48 non-overlapping secondary receivers (77 percent) responded.

three credits for his/her work. The 12 faculty members who co-taught the Nature of Evidence course in 1974 adopted Guided Design in varying degrees in their other classes. Some have not yet incorporated the method of Guided Design in their other courses, and have not used the method since Fall, 1974.

Professor Wales received a grant in 1975, from the Lilly Endowment Fund to promote improved teaching by the faculty at WVU. The program includes five mentor-intern pairs. Mentors are faculty who have been teaching for several years, and the interns are newly hired faculty with relatively fewer years of teaching experience. The disciplines represented are education, geography, engineering, philosophy and psychology. Professor Wales is the Director of the project and Professor D'Amour is one of the mentors. All of the five intern-mentors chose to use Guided Design. This program may be extended to the training of graduate students as teachers.

Data-Collection at West Virginia

We gathered data in a two-step fashion at WVU. First, we sent mailed questionnaires to the information requestors, and then a mailed questionnaire to all (non-overlapping) secondary receivers, who were nominated by the primary information requestors.

Fifty-two information requestors were mentioned by Professor Wales as (1) having requested information about Guided Design from him, or (2) having helped teach the Nature of Evidence course in 1974, using Guided Design, or (3) serving as mentor-interns of the Lilly Endowment program at WVU in Fall, 1975.

The sequential steps in data-collection were:

1. Personal interviews in October, 1974 with 12 individuals at WVU, and with an additional eight individuals in December 1975, plus six re-interviews with October, 1974 respondents.
2. A mailed questionnaire was sent to 32 information requestors. A follow-up was sent within five weeks of the first mailing, resulting in a final response-rate of 83 percent.

The 52 information requestors reported 87 dyadic pairs with secondary receivers in which Guided Design was discussed. However, 39 of these 87 contacts were with other information requestors; these "overlapping" dyads were dropped from our analysis, leaving 48 secondary receivers.

We sent a mailed questionnaire to these 48 secondary receivers in March, 1976, and after we sent a follow-up, we obtained a response rate of 77 percent.

The 48 secondary receivers nominated a total of 54 colleagues at WVU with whom they had talked about Guided Design. But 39 of the 54 contacts were either information requestors or secondary receivers; who were already in our network for Guided Design at WVU but were mentioned again. We dropped these 39 overlapping contacts from our diffusion network, which left us with 15 tertiary receivers.

Characteristics of the West Virginia University Network

Table 15 shows there are 43 individuals who either have used or are currently using Guided Design in their courses. They represent 16 of the 26 disciplines of the information requestors and secondary receivers (Table 16).

Table 17 indicates that most of the information requestors and secondary receivers had a doctorate degree and were involved in undergraduate teaching. The average age is 37 years, with about seven years' experience in teaching at West Virginia University.

It is, of course, unusual to have 52 information requestors, 48 secondary receivers, and 44 adopters of an innovation on the same university campus, as is the case at West Virginia University. Clearly the main reason is the presence of the innovation's inventor, Professor Charles Wales, and the efforts he has made to diffuse the idea on his own campus. Faculty at WVU are not eligible for implementation grants under the IMPACT program, and so the rapid diffusion and adoption is all the more impressive. Especially noteworthy is the spread of the innovation from engineering, where Professor Wales pioneered Guided Design, to other disciplines (as we note in Table 16).

Further, there is an interpersonal diffusion network for Guided Design at WVU, as evidenced by the high degree of "overlapping" contacts (that we noted in Figure 4). In other words, the individuals were interconnected by a variety of interpersonal communication flows about

Table 15. Adoption of Guided Design by Information Requestors and Secondary Receivers at West Virginia University

Adoption Status	Information Requestors (N=43)*	Secondary Receivers (N=37)**	Total (N=80)
1. Have used Guided Design or are currently using it	33 (77%)	11 (30%)	44 (55%)
2. Have never used Guided Design	10 (23%)	26 (70%)	35 (45%)
Totals	43 (100%)	37 (100%)	78 (100%)

---

* Of the 52 primary receivers, 9 (17 percent) did not respond to our question about their adoption of Guided Design.

** Of the 48 secondary receivers, 11 (23 percent) did not respond to our question about their adoption of Guided Design.

Table 16. Discipline of the Information Requestors and Secondary Receivers of Guided Design at West Virginia University

	Discipline	Information Requestors and Secondary Receivers Who were Sent a Mailed Questionnaire (N=100)	Information Requestors and Secondary Receivers Who Responded (N=80)
1.	Engineering	14	13
2.	Nursing	13	12
3.	Counseling and Guidance	10	7
4.	Education	10	6
5.	Geography and Geology	5	5
6.	Physics	5	4
7.	Social Work	5	3
8.	Drama	4	4
9.	Wildlife Management	4	4
10.	Psychology	4	4
11.	History	4	2
12.	English	3	2
13.	Sociology	2	2
14.	Philosophy	2	2
15.	Anatomy	2	2
16.	Administrators	2	0
17.	Music	2	0
18.	Anthropology	1	1
19.	Biology	1	1
20.	Computer Science	1	1
21.	Graphic Art	1	1
22.	Library Science	1	1
23.	Political Science	1	1
24.	Family Resources	1	1
25.	Journalism	1	0
26.	Economics	1	1
	Totals	100	80

Table 17. Personal and Institutional Characteristics of Information Requestors and Secondary Receivers in the WVU Network for Guided Design

Personal and Institutional Characteristics	Information Requestors and Secondary Receivers (N=80)
1. Percentage with doctorate degrees	72%
2. Percentage who are teaching faculty	94%
3. Average age (in years)	37
4. Average years at WVU	7
5. Number of seven teaching innovations adopted	4
6. Weight given to teaching in the perceived reward structure (out of 100 points)	61

Guided Design; the diffusion of the innovation was not a linear, one-way flow from Professor Wales to the tertiary receivers through the information requestors and secondary receivers. One indication of the interconnectedness of the network at WVU is the relatively small number of tertiary receivers (only 15), which suggests the high percentage of overlapping (as well, perhaps, as the fact that the time of our data-gathering left a much shorter time for tertiary diffusion to occur).

We cannot make a clear distinction in the interpersonal diffusion process between the stages of information requestors, secondary receivers and tertiary receivers at WVU. For instance, some of our "secondary receivers" complained that they had heard about the innovation at the same time as (or earlier than) their nominator, an "information requestor". The names of the information requestors were provided by Professor Wales, who kept a record of all those individuals who requested information about the Guided Design from him. But our classification of secondary and tertiary receivers may be even more arbitrary. The unavoidable arbitrariness of our categorization is one caveat that should be kept in mind when reading the following analysis of the WVU network.

Diffusion Networks at the Three WVU Sub-Campuses

Figures 5, 6, and 7 are sociograms of the diffusion networks for Guided Design on the three sub-campuses of West Virginia University.

1. The Evansdale Campus, where Professor Wales is physically located, has the greatest number of faculty members involved in Guided Design as information requestors, secondary receivers, and tertiary receivers, and number of adopters. Professor Wales is jointly appointed in the College of Engineering and the College of Education, both of which are located on the Evansdale Campus.* Figure 5 shows that one individual, #14, has many links to the other two sub-campuses, and hence plays a liaison role in linking these sub-networks at WVU.

2. The Downtown Campus, where Professor Gene D'Amour is located, is the secondary center for Guided Design at WVU. Professor D'Amour (individual #26) is the key node in this part of the Guided Design network, as indicated in Figure 6. His department, Philosophy, is located in a building where most of the social sciences are located, with the student union just across the street. Several of the individuals shown in Figure 6 were involved in the course on the Nature of Evidence. A majority of these individuals on the Downtown Campus have not yet incorporated Guided Design in their regular courses, after their first brush with the innovation in 1974 or 1975.

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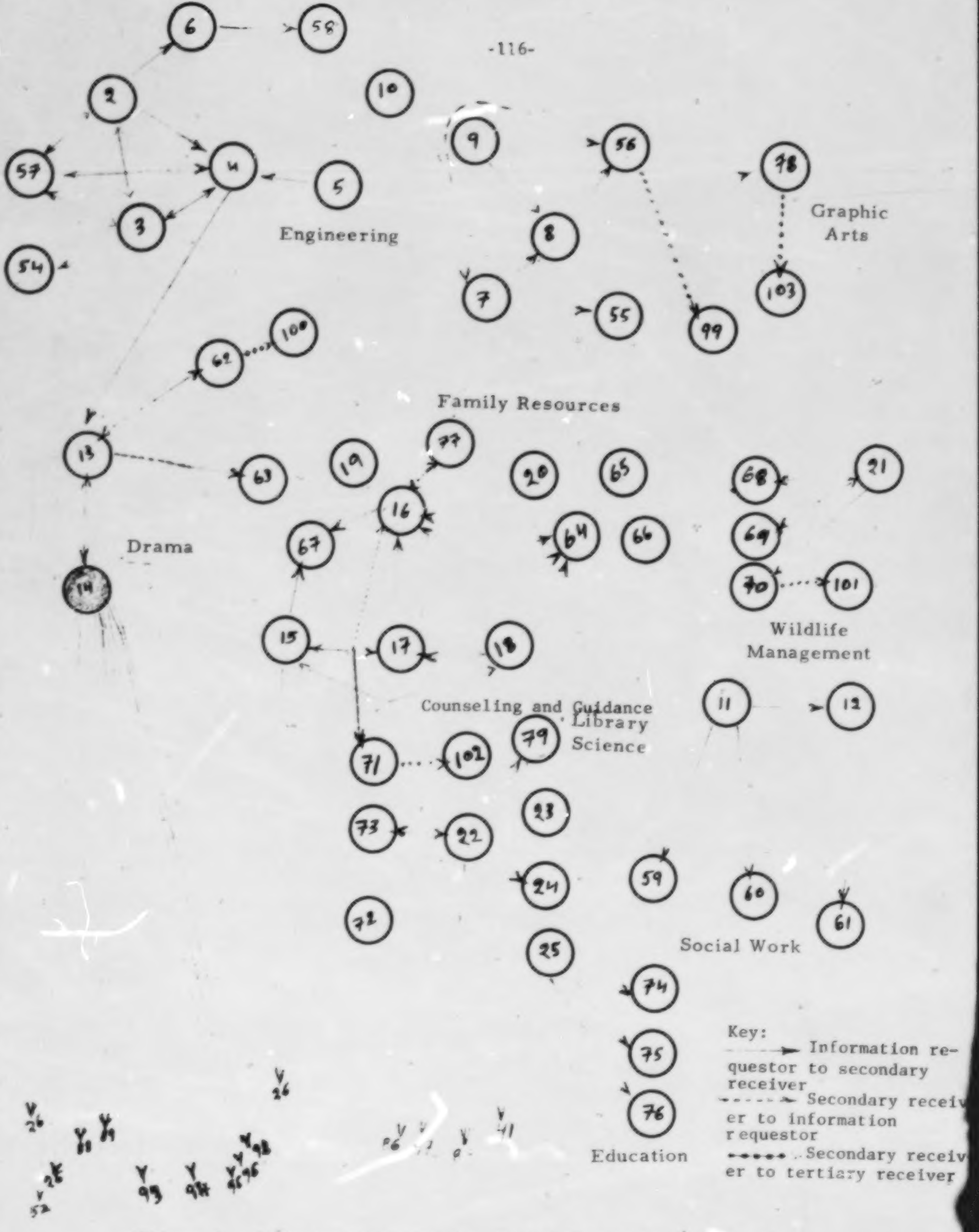
*We have not shown Professor Wales in Figure 5 because he has so many links with these other faculty that the network becomes very confusing.


Engineering
Graphic Arts
Family Resources
Drama
Wildlife Management
Counseling and Guidance
Library Science
Social Work
Education
2
6
58
10
9
56
78
57
4
5
3
8
54
103
7
55
99
62
100
13
63
19
77
16
20
65
68
21
67
64
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69
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71
102
79
73
22
23
24
59
60
61
72
25
74
75
76
26
80
89
28
52
93
94
95
96
98
41
Key:
Information requestor to secondary receiver
Secondary receiver to information requestor
Secondary receiver to tertiary receiver

Figure 5. Diffusion Networks for Guided Design on the Evansdale Campus of West Virginia University.

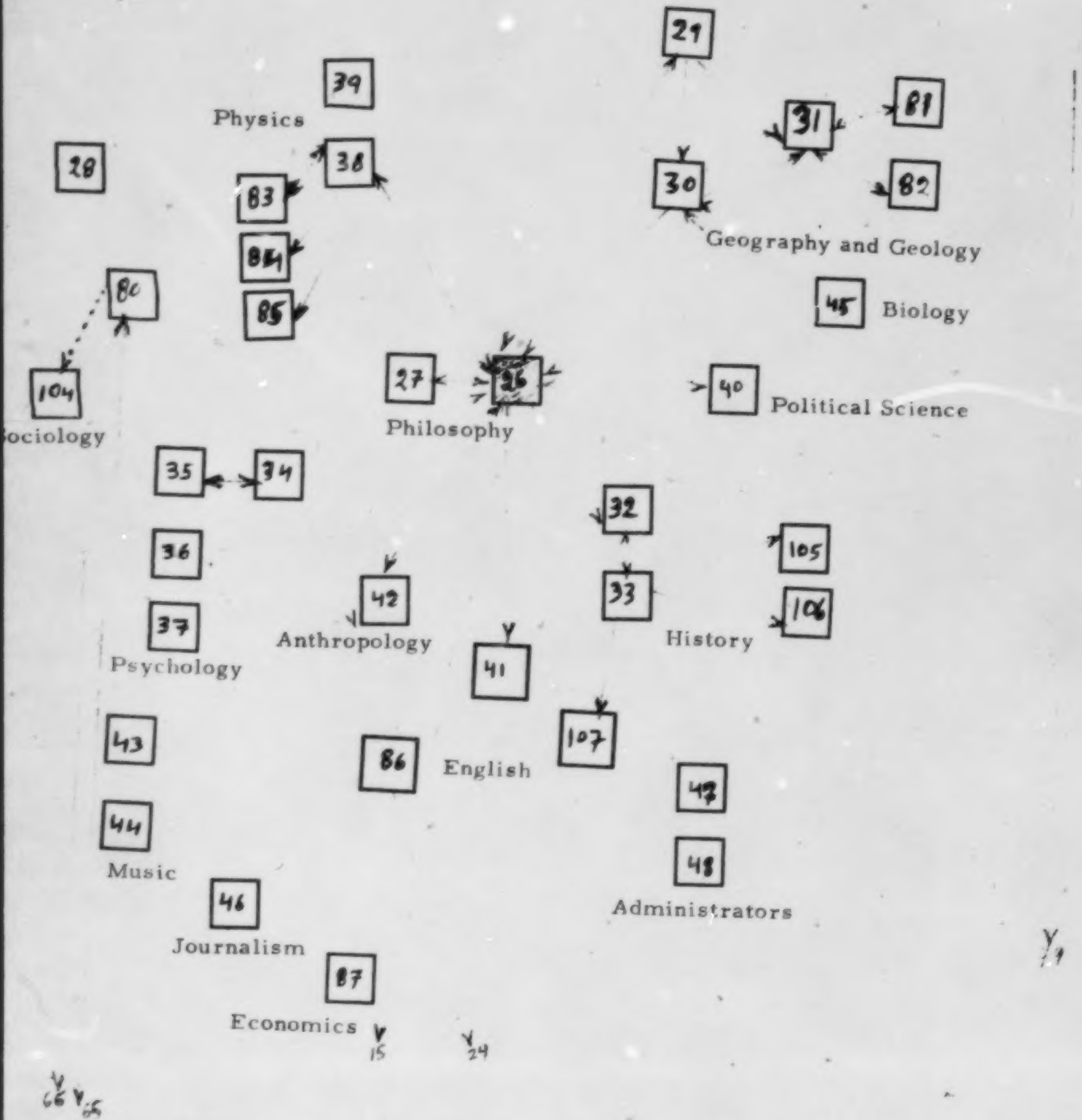
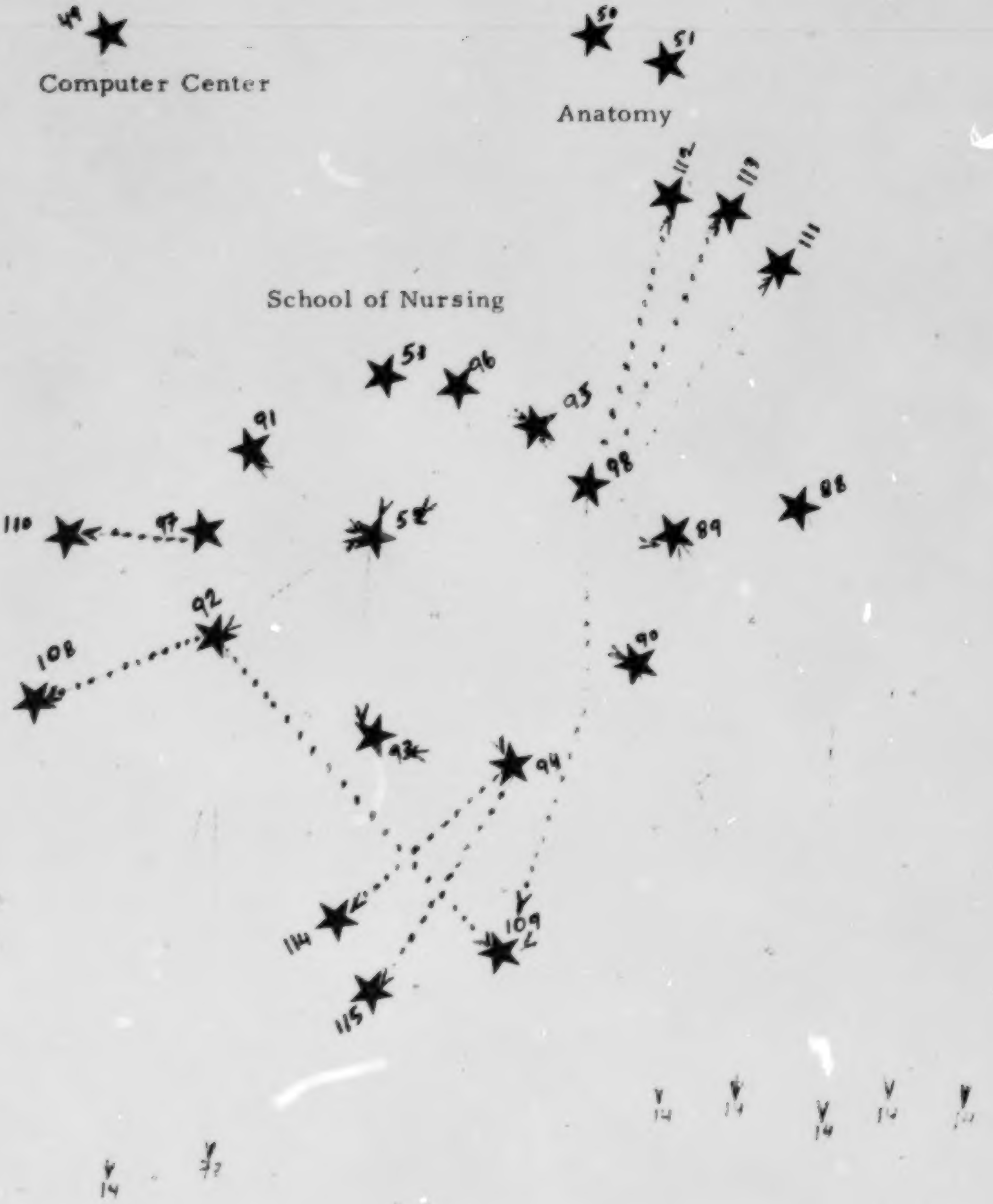

29
39
Physics
38
31
81
28
83
30
82
84
Geography and Geology
80
85
45
Biology
104
27
26
40
Political Science
ociology
Philosophy
35
34
32
105
36
42
33
106
37
Anthropology
History
Psychology
41
107
43
86
English
47
44
Music
48
46
Administrators
Journalism
19
87
Economics
15
24
66
65

Figure 6. Diffusion Networks for Guided Design on the Downtown Campus of West Virginia University.


49
Computer Center
50
51
Anatomy
112
113
111
School of Nursing
57
96
95
91
98
88
110
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52
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92
108
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93
94
114
109
115
14
14
14
14
14
14
77

Figure 7. Diffusion Networks for Guided Design on the Medical Center of West Virginia University

3. The Medical Center features a rather integrated, discipline-dominated network of individual faculty members interested in Guided Design. The liaison person (#14) from the Evansdale Campus helped design and teach a course in Nursing using Guided Design. The network in Figure 7 centers around the teacher of this nursing course (52) who had external contact with #14 from the Evansdale campus.

Figures 5, 6, and 7 obviously indicate that interpersonal diffusion networks for Guided Design at West Virginia University are determined in part by space and discipline. There is much less interpersonal diffusion between the three sub-campuses, than there is within each sub-campus.

We also find that adopters of Guided Design are more actively involved in interpersonal diffusion than are non-adopters.* The average information requestor who has adopted Guided Design talked to 2.40 individuals, as compared to his/her non-adopting counterpart who talked to 1.11 individuals. The comparable figures for secondary receivers are 2.09 individuals for adopters, and 0.96 individuals for non-adopters. So adopters tend to be more actively involved in interpersonal diffusion of an innovation, whether information requestors or receivers.

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*The present finding supports our earlier result that the adopters of an IMPACT innovation are more actively involved in interpersonal diffusion than non-adopters.

Much further analysis could be done with the WVU diffusion network data in order to explore such questions as the relationship of disciplinary homophily to outcome of the dyadic interaction (for example, as to whether adoption of the innovation occurred or not), etc. We intend to follow up such research issues as these in the future.

But we have presented the Guided Design diffusion network here in some detail to provide the reader with a micro-level picture of the spread of a teaching innovation on one university campus.

University of Wisconsin Center System Network

The staff of the Carnegie Commission on Higher Education estimated that by 1980 3.6 to 4.3 million students will be enrolled in community colleges. A need for 230 to 280 new community colleges is projected within the next 10-year period. About one-third of all high school graduates each year enter community colleges.

The Medsker and Tillery (1971) study of junior colleges indicates that most of the faculty members recognized that counseling and guidance were an integral part of the educational programs in their colleges. Community colleges recognize the need to provide improved counseling services. One method is to train student counselors. Student-to-Student counseling stresses the role of faculty in the preparing the student counselors for their task. One estimate shows that in two-year colleges, a ratio of one counselor to 300 students is only rarely found (Raines, 1966).

We decided to study the diffusion network in a community college system, as explained previously. We chose the University of Wisconsin Center System - Washington County, as the center of this investigation. We conducted a small "roster" study at this community college system. Our general purpose was to observe how grantees and faculty members at community colleges differ from their counterparts in other types of institutions regarding the interpersonal diffusion of an IMPACT innovation.

We studied the diffusion network among 16 persons on the 14 campuses of the System who were associated with student services (including counseling). The main findings are as follows:

1. Thirteen of the respondents are directors of counseling services within the University of Wisconsin Center System.
2. A majority of the respondents first heard about the innovation (Student-to-Student Counseling) from Professor Roland Baldwin, who spoke at a meeting of these directors. The rest heard about the innovation through the other administrators, or via the IMPACT brochure.
3. A majority (83 percent) were exposed to the IMPACT brochure, which was mailed to them directly by the Exxon Education Foundation, or was passed along by other administrators at their college.

4. Most of the student services directors learned about Student-to-Student Counseling between April, 1973 and September, 1974 (the IMPACT program was launched in November 1973).

5. The average director possesses at least a Masters' degree, and has been at his/her present institution for six years. The average respondent is 42 years old, and typically male. Eighty-six out of the 100 possible points were allocated to counseling effectiveness as a main factor in the reward structure for their position.

6. None of the respondents had adopted Student-to-Student Counseling at the time of our data-gathering in early 1976. Roland Baldwin received an Exxon Education Foundation implementation grant. The other student services directors did not adopt the innovation because of:

   (1) The unavailability of funds.

   (2) Too time-consuming, and a lack of release time to prepare materials.

   (3) The unavailability of trained personnel (counselors).

   (4) A questioning of the value of student counseling.

The roster-type sociometric question that we asked 16 respondents was: "We are interested in the role of the University of Wisconsin Center system in facilitating the discussion of counseling matters. How often do you discuss, in general, counseling matters with each of the following individuals?" The other 15 respondents' names were listed with five response categories for each: (1) never, (2) about once a day, (3) once a week, (4) once a month, and (5) once a year.

Figure 8 shows the who-to-whom matrix; it suggests that much of the interpersonal communication occurs at the annual meeting of the directors. Several of the respondents have almost no contact at all with the other respondents; certainly this is a very weakly interconnected network.

There is very little interpersonal communication between the IMPACT grantee for Student-to-Student Counseling and his counterparts on the other campuses in his state system of community colleges. As we saw in our previous case study of the West Virginia University network, *physical space is a very important determinant of which faculty member interacts with whom about an IMPACT innovation*, and whether such interpersonal diffusion occurs at all. Because the 14 centers in the present system are geographically scattered, the innovation did not diffuse rapidly nor extensively among the members.

"WHOM"

		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	#16
	# 1	-	2	3	1	1	1	1	1	1	1	1	1	1	1	1	1
	# 2	2	-	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	# 3	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0
	# 4	2	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0
	# 5	2	1	1	1	-	1	1	1	1	1	1	2	1	1	1	1
	# 6	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0
"WHO"	# 7	2	0	1	1	1	1	-	2	1	2	1	1	1	0	1	2
	# 8	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0
	# 9	0	0	0	1	0	1	1	1	-	1	1	1	1	0	1	1
	# 10	2	0	0	1	1	2	1	0	2	-	0	0	2	0	1	1
	# 11	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
	# 12	2	0	0	1	0	0	1	1	1	1	1	-	1	0	1	1
	# 13	0	0	0	1	0	0	1	1	1	1	1	1	-	0	1	1
	# 14	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0
	# 15	2	0	1	1	0	1	1	1	1	1	1	1	1	0	-	1
	# 16	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-

Key:
0 = Never
1 = Once a year
2 = Once a month
3 = Once a week
4 = Once a day

Figure 8. Who-to-Whom Matrix for Inperpersonal Communication about Counseling at the University of Wisconsin Center System.

Stockton State College Network

We studied an interpersonal network at Stockton State College, a four-year arts and sciences state college, in order to investigate such issues as:

1. What role a spontaneous adopter plays in the diffusion of a computerized innovation through a state-wide educational computing network.
2. Do computer-related innovations diffuse more slowly than non-computerized innovations when technical assistance and computer programs are available via a centralized system with easy access and considerable financial backing?

Professor Kenneth Tompkins of Stockton State College attended the October, 1974 TIPS workshop at Duke University. He attended with a grant from the State of New Jersey to implement TIPS on his campus. In the following winter, he implemented TIPS in his course, and assisted a colleague in using TIPS in her psychology course.

The following May (1975), Professor Tompkins, aided by the Director of the New Jersey Educational Computing Network held a workshop to train faculty members from the eight state colleges in implementing TIPS. All of the 26 persons who attended the workshop received our questionnaire. They had access to the centralized computer network on which the TIPS computer program was running.

Our main findings are as follows:

1. A majority of the respondents heard about the innovation through a newsletter sent by the NJ ECN in early 1975 (January and March).
2. All of the respondents mentioned that their institution belongs to the New Jersey Educational Computing Network, and this fact facilitated their interest in TIPS.
3. The average respondent had been at his/her present institution for about five years, and the average age was 40 years. A majority (N=15) had taught at least one course during the past year in which the average student enrollment was 65 students or more. Most of the respondents held a doctorate degree (in such fields as English, psychology, languages, mathematics, geology, and economics).
4. Most of the respondents were not actively involved in secondary diffusion about TIPS. Four of the 16 respondents mentioned that they had talked about TIPS

to colleagues within their own department, as well as within the same institutions but in different departments. Of these four respondents, three also recalled talking to colleagues at other institutions. So there is little secondary diffusion about TIPS by these respondents, at least at the time of our data-gathering.

5. The use of computers by the respondents is mostly limited to research (eight of 15 respondents); only one of these eight used computers for teaching purposes.

In this section we have presented data about three local diffusion networks for an IMPACT innovation. One of these, at West Virginia University, is an unusually active network centering around the inventor of Guided Design and several other key faculty members. The second system that we analyzed represents an especially sparse network in that little interpersonal communication occurred; this is one possible reason why little diffusion of Student-to-Student Counseling occurred through it. The New Jersey network for TIPS is a computer-centered network comprised of geographically-dispersed individuals; little diffusion had occurred at the time of our study.

DIFFUSION STRATEGIES IN HIGHER EDUCATION

Our research question #6 is: What is the relative effectiveness of various strategies for diffusing educational innovations?

Here our purpose is to identify particularly useful diffusion strategies that are currently being utilized by various programs promoting innovations in higher education.*

During the conduct of our present research we identified two main approaches to innovation in higher education: (1) an innovation specific strategy, and (2) a general change strategy. An innovation specific strategy is a plan designed to diffuse a particular new idea, object, or practice among the members of an audience. The IMPACT program is an example of an innovation specific approach. A general change strategy is a plan designed to create a climate for innovation by promoting change and development among an audience, that may encourage the adoption of a variety of different innovations. An illustration of a general change strategy is the Strategies for Change and Knowledge Utilization Project, headquartered at Empire State College (and to be described shortly).

We investigated these two strategies for diffusing educational innovations as they were followed by one or more of eight programs facilitating change and innovation in higher education.

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*We have also been analyzing the National Diffusion Network, a U.S. Office of Education-sponsored diffusion program aimed at elementary and secondary schools in the U.S. The NDN bears a close resemblance to the IMPACT program in that local inventors diffuse their innovation horizontally to peers in other schools. The NDN follows an innovation-specific strategy for a relatively large number of innovations (about 150).

1. NEXUS, supported by the Fund for the Improvement of Postsecondary Education.
2. Lilly Endowment Fund.
3. Kellogg Foundation.
4. CONDUIT.
5. Spencer Foundation.
6. Danforth Foundation
7. National Science Foundation.
8. Strategies for Change and Knowledge Utilization Project, Empire State College, funded by NIMH.

We contacted each of these programs in order to analyze their diffusion strategies, and compare them with the IMPACT program. We developed a general list of diffusion/adoption strategies that are used by one or more of these programs, as reflected in their activities.

1. Encouraging R&D to develop educational innovations.
2. Founding a teaching and learning center on a university campus, designed to encourage innovation in teaching.
3. Providing seed money for adopting an innovation to adopters.
4. Demonstrating an innovation in use to other university professors.
5. Training selected teaching fellows in certain innovations, such as through the assistance of master teachers.
6. Providing information resources about innovations, on demand.
7. Establishing a multi-university consortium to link a number of institutions so that they are better able to (1) assist each other in adopting innovations, or: (2) to seek external assistance.

8. Providing equipment or other resources necessary for adopting an innovation.
9. Disseminating materials (for example, computer programs) among universities, so as to facilitate the adoption of innovations.
10. Encouraging change in teaching, with the exact nature of the innovations left up to the professors involved (an example is the creation of a faculty development center at a university).

We selected three of these programs for a detailed examination of their strategies for diffusing innovations in higher education.

1. NEXUS
2. CONDUIT
3. Strategies for Change and Knowledge Utilization Project

NEXUS

NEXUS is a program conducted by the American Association of Higher Education in July, 1973, and put into action in January, 1974 as a telephone referral service for postsecondary education. Its purpose is to help people wishing to start new educational programs by getting them in touch with knowledgeable people or with helpful materials.

This Washington, D.C.-based program is a non-computerized, cross-referenced system operating on a national basis. It is not a reservoir of research and information per se, but rather a referral service intended to tell where information exists and to refer people to that information by telephone.

Thus, anyone wishing to start a new program can call NEXUS and explain their information needs. A NEXUS staff person will either direct the inquirer immediately to a source of information, or, if some search is needed, call the inquirer back, usually within two working days. The inquirer is thus placed in contact with a referral who may have already tried the innovation. The inquirer pays only for the price of the telephone call.* NEXUS also receives requests by mail, and will either mail a reply or call back. Mail channels do not allow the NEXUS staff to ask probing questions.

NEXUS provides referral help on such topics/problems/needs as:

1. Providing information for someone else, such as a committee, faculty member, or student.
2. Help in finding sources of information for purposes of writing proposals.
3. Help in doing research - while NEXUS tries to avoid doing research for clients, it does help obtain new information for them that has not yet been published.

From July-December, 1974, NEXUS handled 725 inquiries (a 50 percent increase over the previous six months) while increasing its store of references to several thousand people, publications, programs, and clearing houses. During 1975 and 1976, NEXUS expanded considerably.

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*In 1977 NEXUS provided a toll-free telephone number.

The main thrust of the NEXUS strategy is to provide linkage of sources and materials of change and innovation to the individuals and institutions who have a felt need for them. Specific strategies used by NEXUS in its information referral services are:

1. Instant help is provided by the person-to-person requests by telephone. Thus delays are avoided when the requestor needs information urgently in order to submit a proposal or to start a new program.
2. Specializing in information which is current and contemporary, and perhaps not yet in print or widely known. Thus, NEXUS helps fill the gap between what is already known and published, and that which is currently happening.
3. Use of an interpersonal network approach in diffusing information on educational innovations and change programs. Nexus' strategy is to bring interested and knowledgeable persons together with individuals needing help, so that diffusion can take place. In other words, secondary and tertiary diffusion is facilitated by connecting a requestor to the source of materials that he/she is interested in.

This third strategy of NEXUS is similar to the IMPACT program, in that secondary diffusion is involved, so that a multiplication effect is built into the program. But the difference is that the IMPACT program is innovation specific, while NEXUS assists the general change process in higher education, as well as the adoption of specific innovations. Both address themselves to audience needs and help towards implementation of innovations, although NEXUS mainly links requestors to relevant sources of information, while IMPACT also provides implementation grants.

CONDUIT

CONDUIT is a national organization originally composed of eight member universities, supported by the funds from the National Science Foundation, whose purpose is to improve undergraduate education through the use of computers. Major CONDUIT activities are rewriting and testing computer-based instructional materials in academic fields such as biology, chemistry, economics, mathematics, political science, geography, psychology, and others. CONDUIT is also involved in developing standards and guidelines for instructional computing programs and materials.

An innovation specific strategy is used by CONDUIT in that it only deals with computer-based instructional materials. CONDUIT acts as a network to connect interested faculty members and institutions of higher education with relevant computer-based instructional materials.

CONDUIT has decided to add EXPER SIM, one of the four IMPACT innovations, to its list of innovations to be distributed

CONDUIT and the IMPACT program are quite similar in that they both focus on a relatively small number of specific innovations. The difference is that CONDUIT only disseminates computer-based innovations. CONDUIT tests and standardizes an innovation before promoting it; the IMPACT program mainly focuses on the dissemination and adoption of innovations, which come out of previous R&D grants by the Exxon Education Foundation.

Strategy for Change and Knowledge Utilization Project

The Strategies for Change and Knowledge Utilization Project was sponsored by the National Institute for Mental Health, and by the Union for Experimenting Colleges and Universities. The main objective of the project was to examine the strategies colleges and universities use for knowledge utilization and change. The change efforts were limited to the undergraduate curriculum, teaching, and evaluation. Eight institutions of varying size were involved in this four-year longitudinal project, headquartered at Empire State College. The institutions were selected on the basis of their interest in innovation, especially in undergraduate education. The project could be labeled as action-research. The project staff intervened in the innovation process through workshops, consultation, and feedback from the research through the four years.

The innovations studied were not determined at the beginning of the project. The eight colleges were all involved in undergraduate curriculum changes, and teaching and evaluation of the teaching process. The institutions selected their own concerns as the focus of their efforts at innovation. Examples include school calendar changes, new forms of evaluation, a problem-centered curriculum, and improving the capacity for identifying and solving educational problems. Thus the approach is a general strategy of change, rather than being innovation-specific. Task forces were set up at each of the eight institutions, after an initial contact with the presidents by the project staff. The task forces varied from 4-20 members; most were ad hoc and appointed by the president of the college. Typically a faculty member or an administrator who was the chief link between the project staff and the campus task force. The project identified these factors as influencing innovation in undergraduate education:

1. Faculty members have major control over actual implementation of an innovation.
2. Administrators are crucial in the decision to change; firm commitment is needed at the highest level.
3. Objective results and gains/benefits of the innovation must be convincing to the skeptical faculty.

4. The external environment has a strong impact on the decision to adopt an innovation, and may create barriers to innovation.
5. Change should be gradual, so that some stability and predictability is maintained, and the innovation must be compatible with existing functions.
6. Change involves rewards; people change their behavior because the innovation would be rewarding to them or to their group. Enhancement of career, self or group prestige, etc. is thus involved in innovation.
7. Strategies, money, and personnel are needed for innovation in education.
8. Follow-up activities are very important factors in the continued adoption of innovations.
9. Linkage with experts at other institutions is important in facilitating innovation.
10. Interpersonal contacts through workshops, faculty retreats, meetings, etc., are important for securing the adoption of innovations.

Comparison of the Two Strategies

In this section we have reviewed three programs of innovation in higher education, compared them with the IMPACT program, and identified certain of their specific diffusion strategies. Both NEXUS and the Strategies for Change and Knowledge Utilization Project illustrate a general change strategy, while CONDUIT is more similar to the IMPACT program's innovation-specific strategy.

What are the main advantages of an innovation specific strategy?

1. Measurement of the effectiveness of the program is facilitated, mainly by being able to count the number of adopters of the specific innovations. Thus evaluation is easier.
2. A closer look at the implementation of new ideas is facilitated as the elements in an innovation are delineated more specifically. An innovation-specific strategy forces one to look into the operational details of an innovation.

In comparison, a general change strategy has certain advantages.

1. Such programs are more likely to be aimed at changing the climate for innovation in an institution, rather than being aimed mainly at individual adopters.

Repeatedly in the present study, we have encountered evidence of the importance of administrators and of the organizational reward structure on individual's innovation-decisions about the four IMPACT innovations.

2. Such an approach begins with the individuals' (or institutions') problems and needs for change, rather than with an innovation. Hence the matching of available innovations with existing problems/needs may be facilitated. The process thus begins with a question, rather than an answer. The need for modification and/or re-invention of the new idea may be minimized.
3. The scope of potential interest in a general change strategy is usually wider than in a specific innovation.

There are numerous general change efforts under way today on university campuses, especially intended to improve the quality of undergraduate teaching/education in an era of cost-consciousness. Faculty development centers are one general change approach; one estimate is that approximately 500 such centers now exist in the United States. One study indicates that the median budget for a faculty development center is in the $50,000 to $100,000 range, with 70 percent of such funds consisting of "hard money."

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APPENDIX A

Throughout the present report, we have used comparisons between information requestors, secondary receivers, and tertiary receivers, with regard to their selected individual and institutional characteristics. This appendix indicates the means and variance for these respondents on five main characteristics: Number of years at the present institution, number of new teaching innovations adopted, age, weight given to teaching in the reward structure, and total enrollment at the institution.

The present Appendix is intended to be helpful in understanding Tables 3, 7, and 8.

Table A-1. Mean and Variance for Certain Characteristics of Information Requestors, Secondary Receivers, and Tertiary Receivers.

Individual and Institutional Characteristics	Information Requestors (N=3,698)		Secondary Receivers (N=109)		Tertiary Receivers (N=73)	
	Mean	Variance	Mean	Variance	Mean	Variance
1. Average number of years at the present institution	$\bar{X}$ = 7	10.8	$\bar{X}$ = 9	69.0	$\bar{X}$ = 8	44.6
2. Number of seven teaching innovations adopted	$\bar{X}$ = 3.1	2.8	$\bar{X}$ = 3.5	4.3	$\bar{X}$ = 3.1	3.1
3. Age in years	$\bar{X}$ = 40 years	17.5	$\bar{X}$ = 41 years	94.2	$\bar{X}$ = 40 years	78.8
4. Weight given to teaching in the perceived reward structure of the institution (out of 100 total points)	$\bar{X}$ = 80 points	53.4	$\bar{X}$ = 71 points	65.2	$\bar{X}$ = 67 points	84.6
5. Total student enrollment at the individuals' institution	$\bar{X}$ = 9,330	17,130.4	$\bar{X}$ = 8,073	--	$\bar{X}$ = 8,489	--